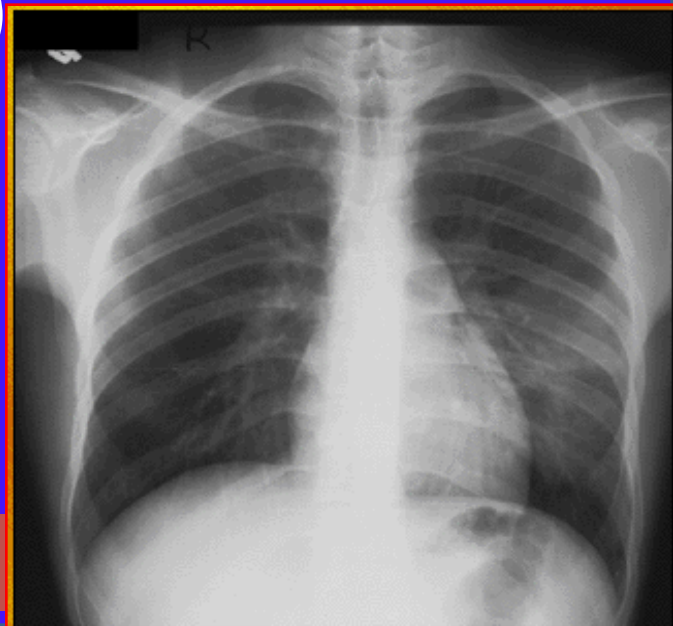
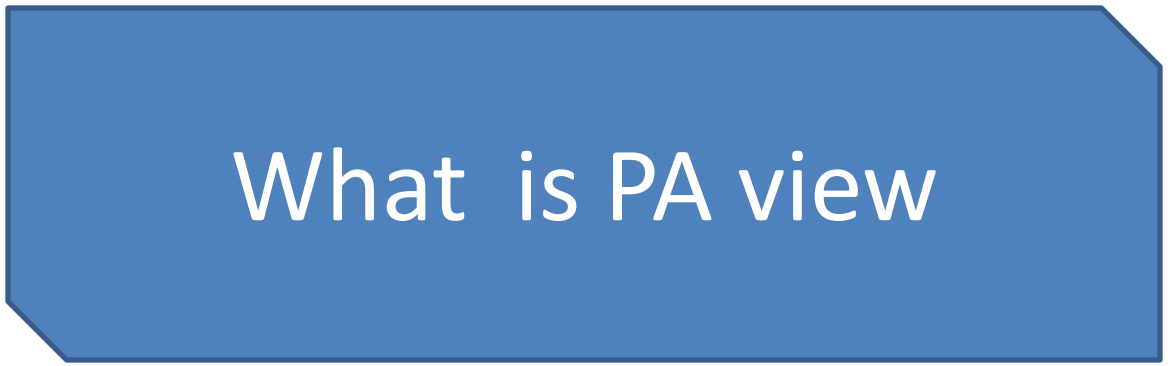


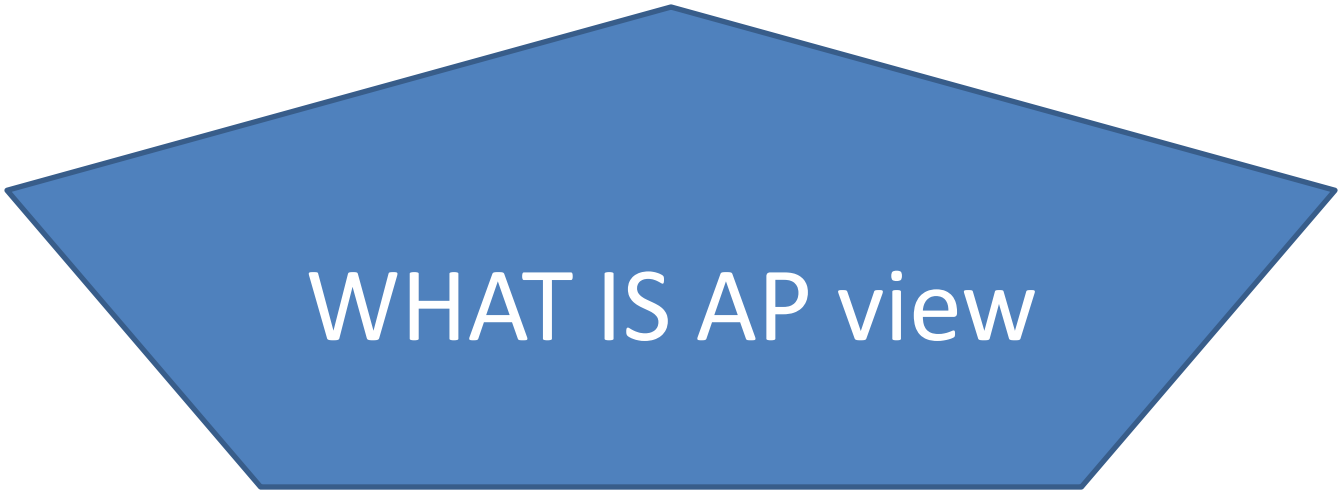
CXR—RAY

Dr. Shahidullah Shamol
FCPS (Medicine)



Dr. SHAMOL/Radio logy


What is PA view


WHAT IS AP view

Dr. SHAMOL/Radio logy

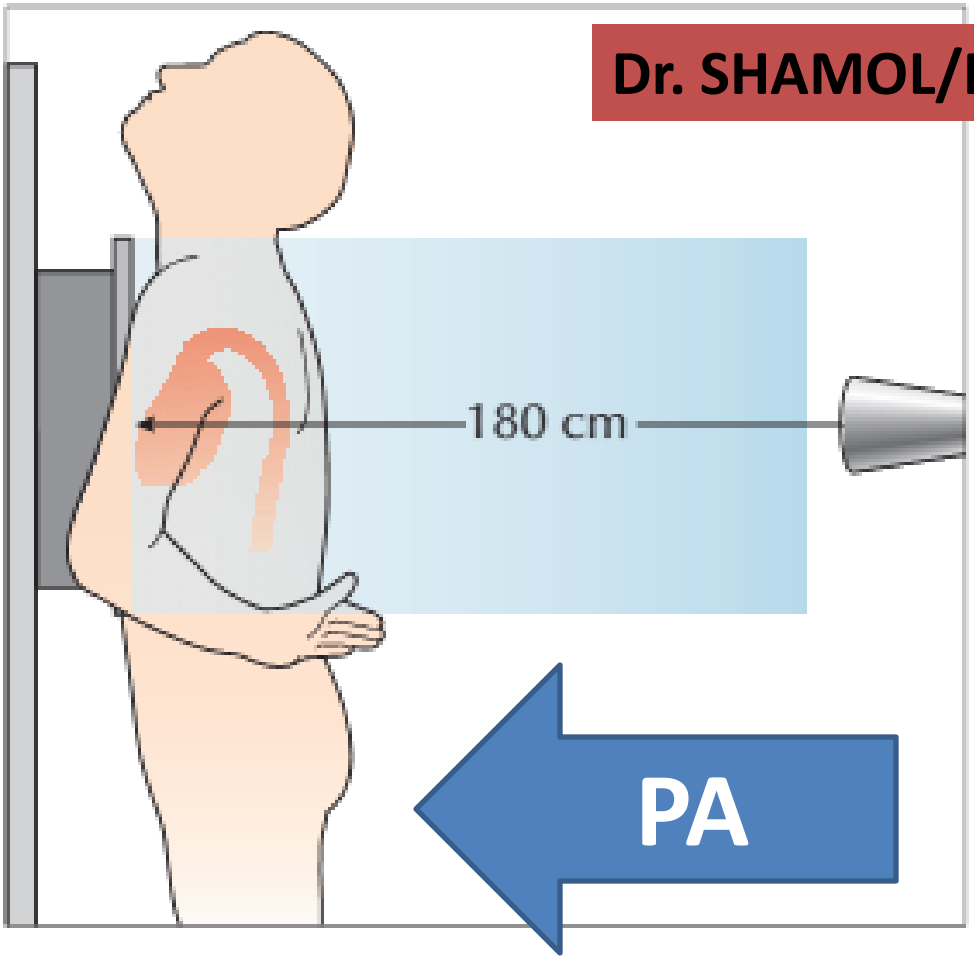


Figure 1.6 *On a PA CXR the heart is situated anteriorly in relation to the cassette. The 180 cm distance means that there is minimal divergence of the x-ray beam. Cardiac magnification is limited.*

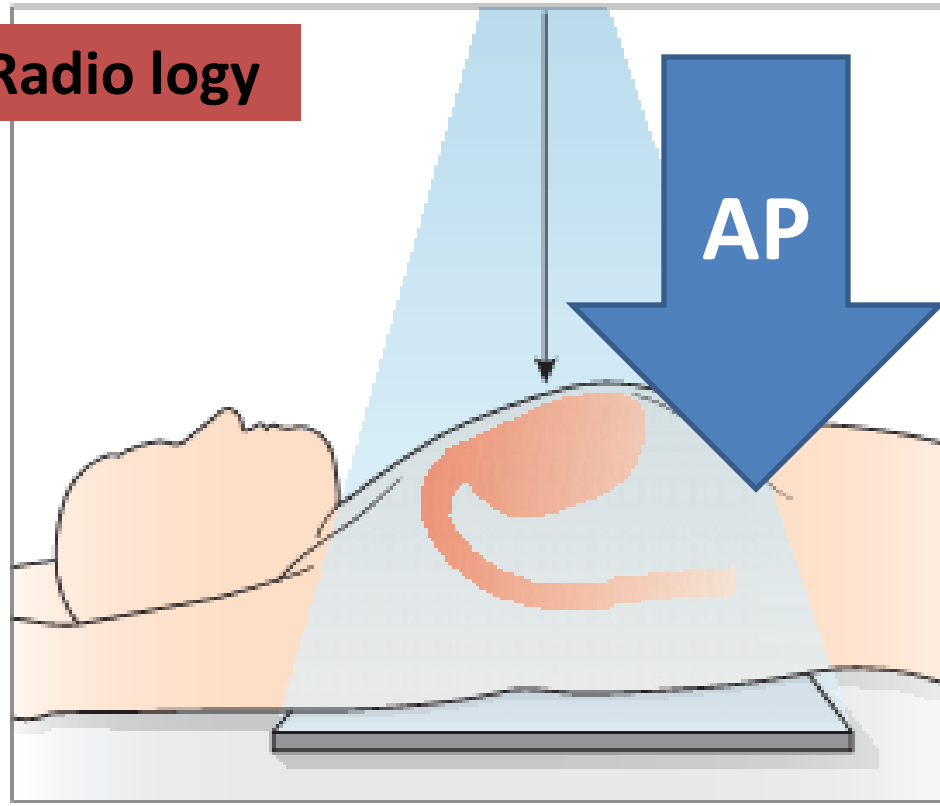
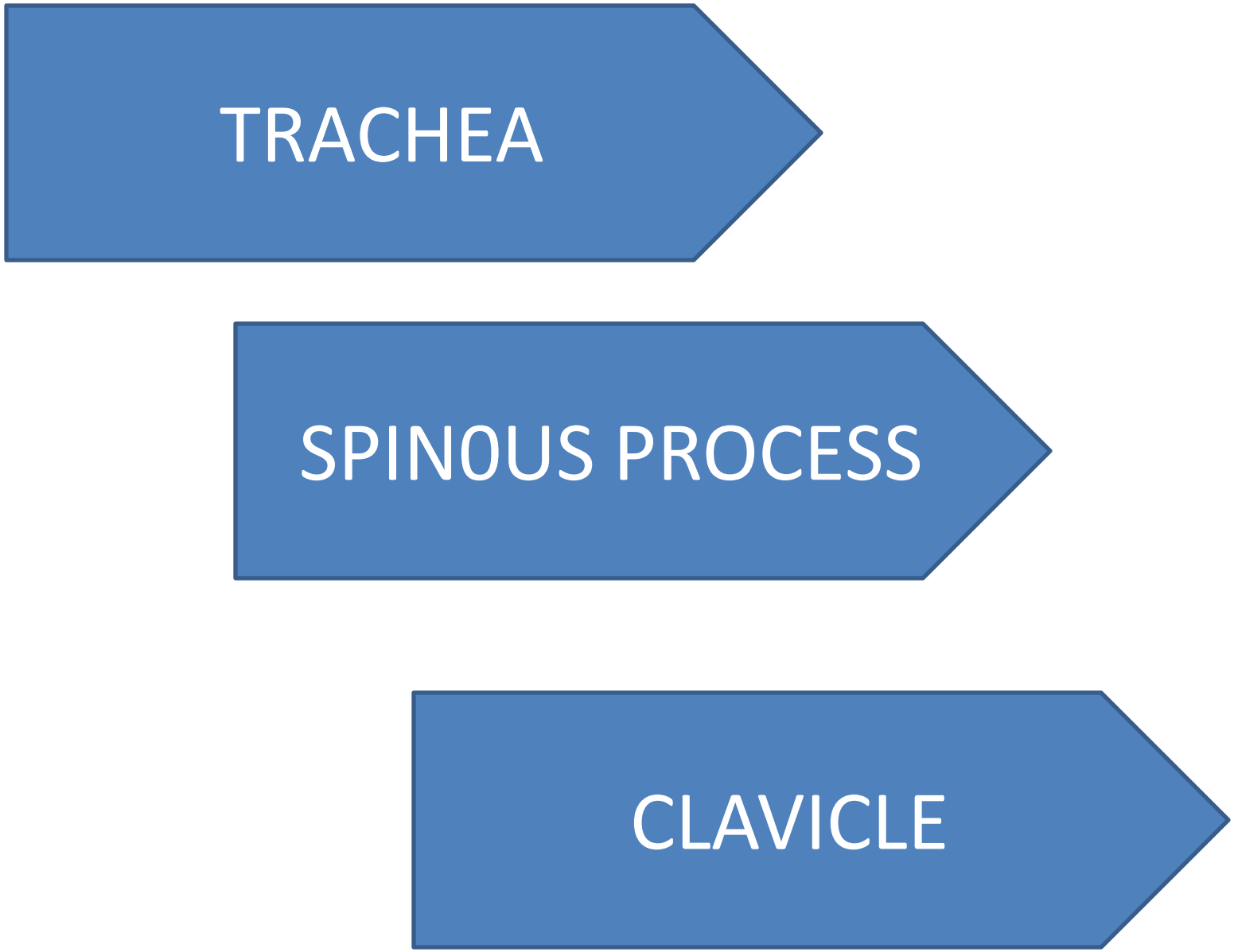
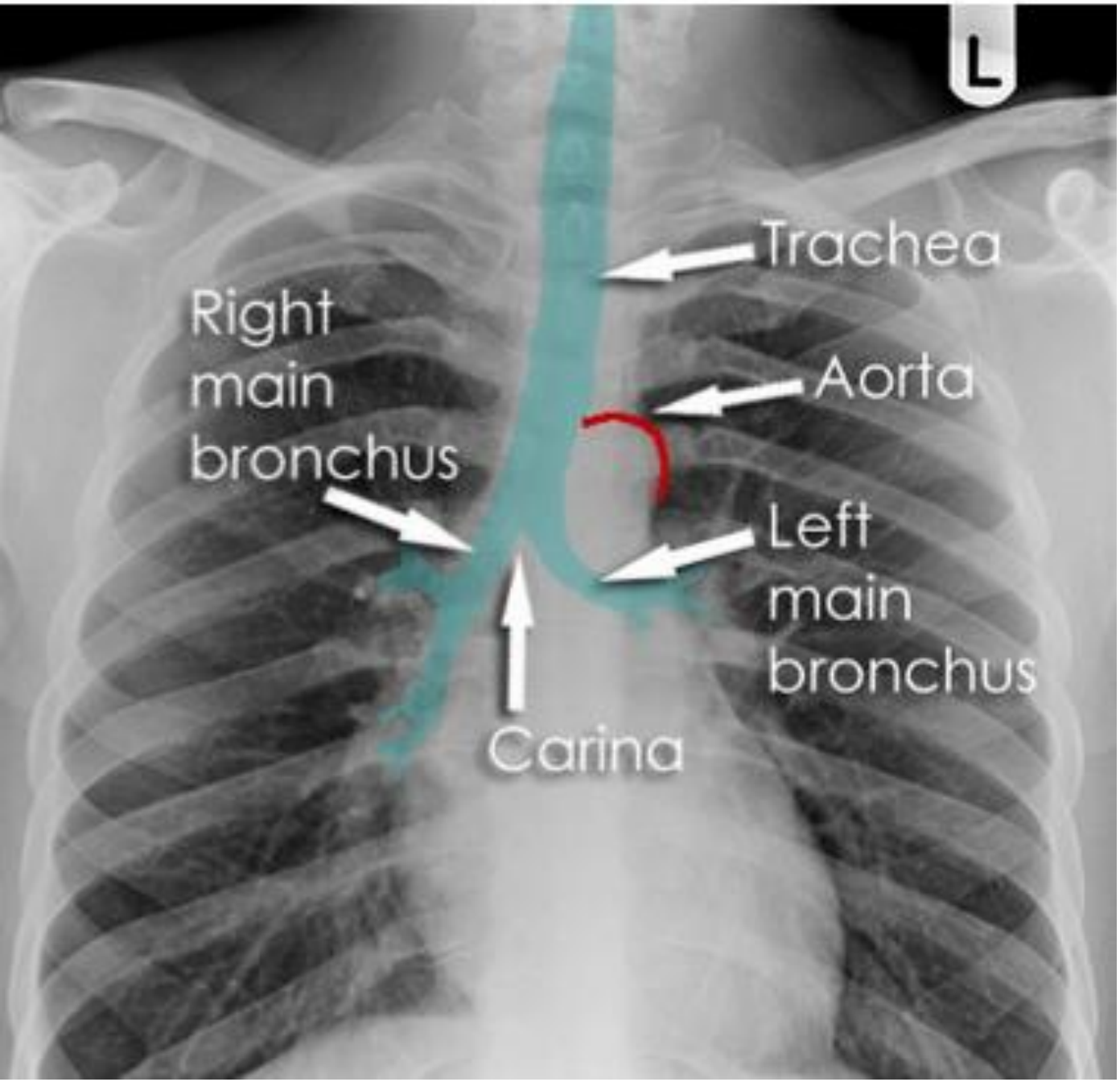
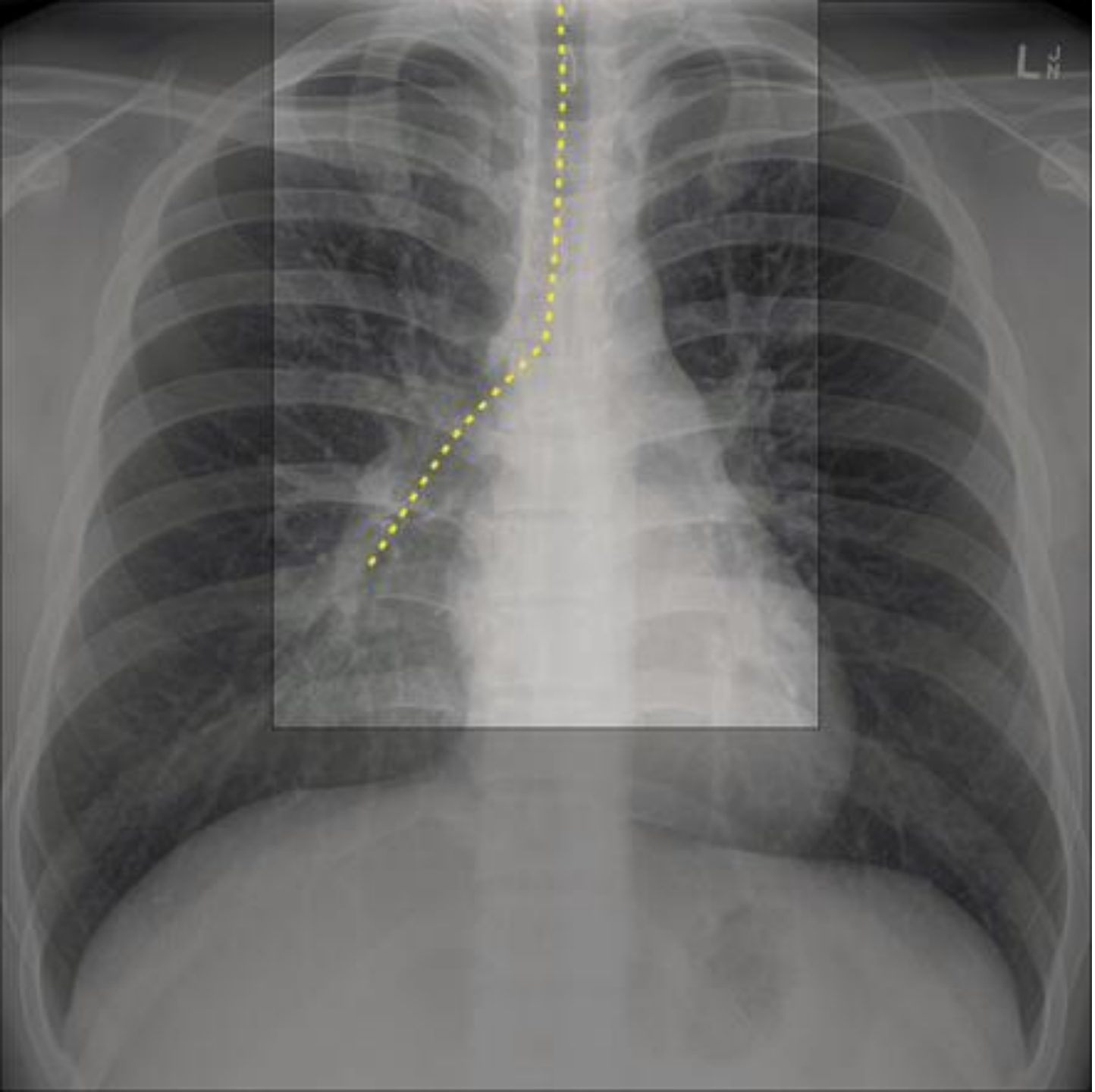


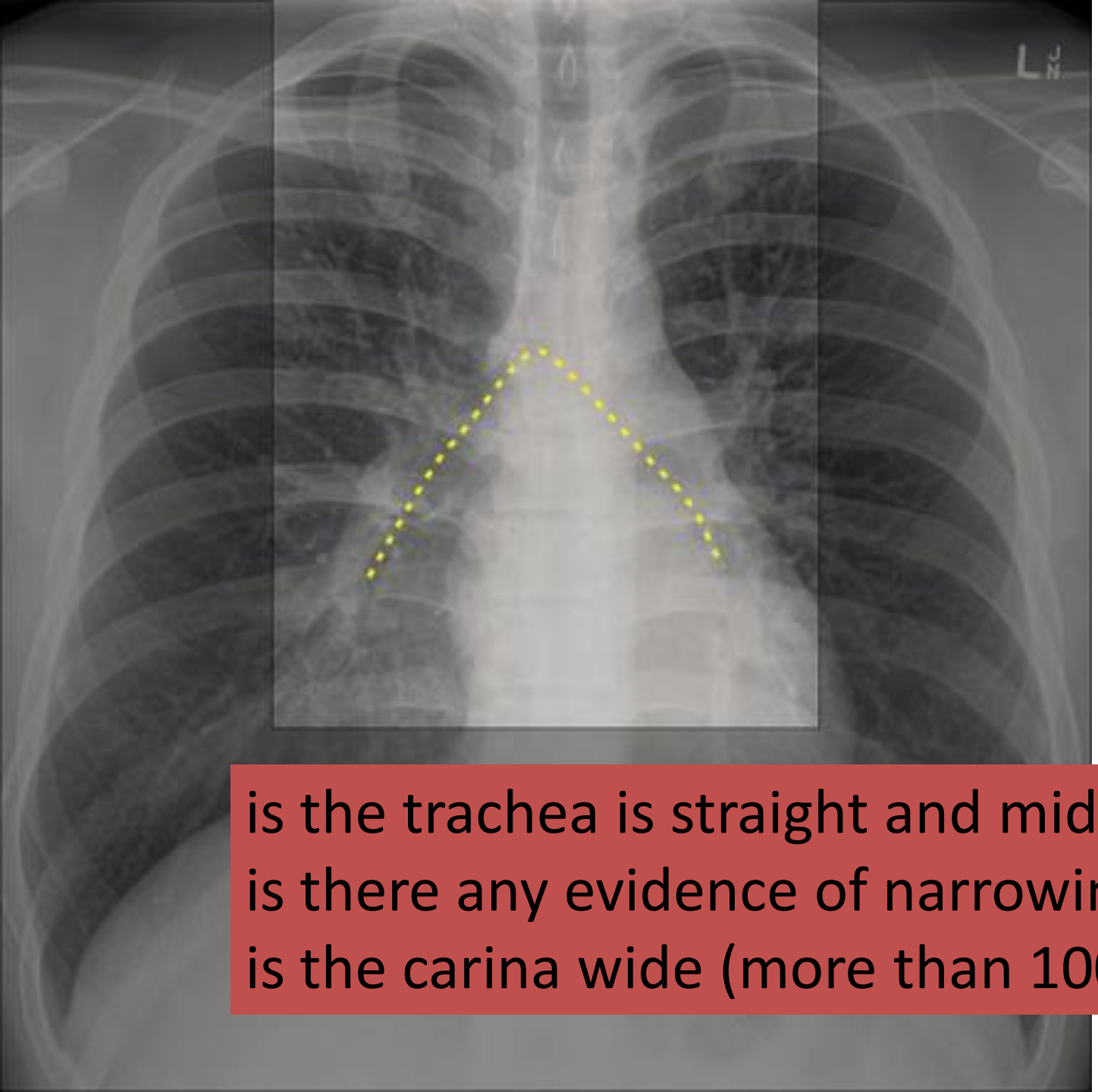
Figure 1.7 *On a bedside (portable) AP CXR the heart is situated well away from the cassette. The x-ray beam diverges at the margins of the heart causing magnification. A second cause for magnification is the shorter distance from the x-ray tube to the cassette. This is invariably less than 180 cm and produces a divergent x-ray beam.*


TRACHEA
SPINOUS PROCESS
CLAVICLE

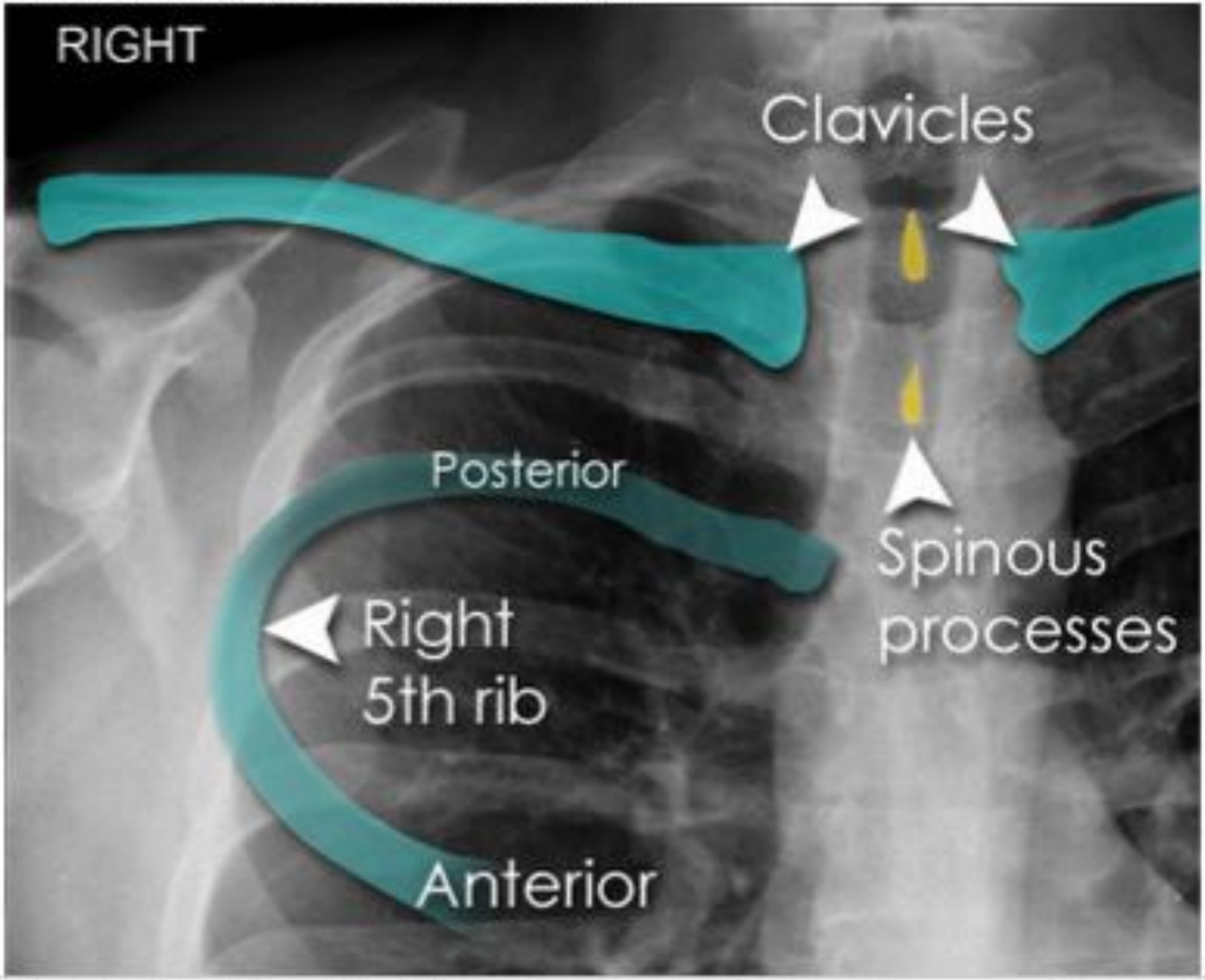


The trachea and bronchi are visible - branching at the carinaThe trachea passes to the right of the aorta and so may be slightly off mid-line to the right



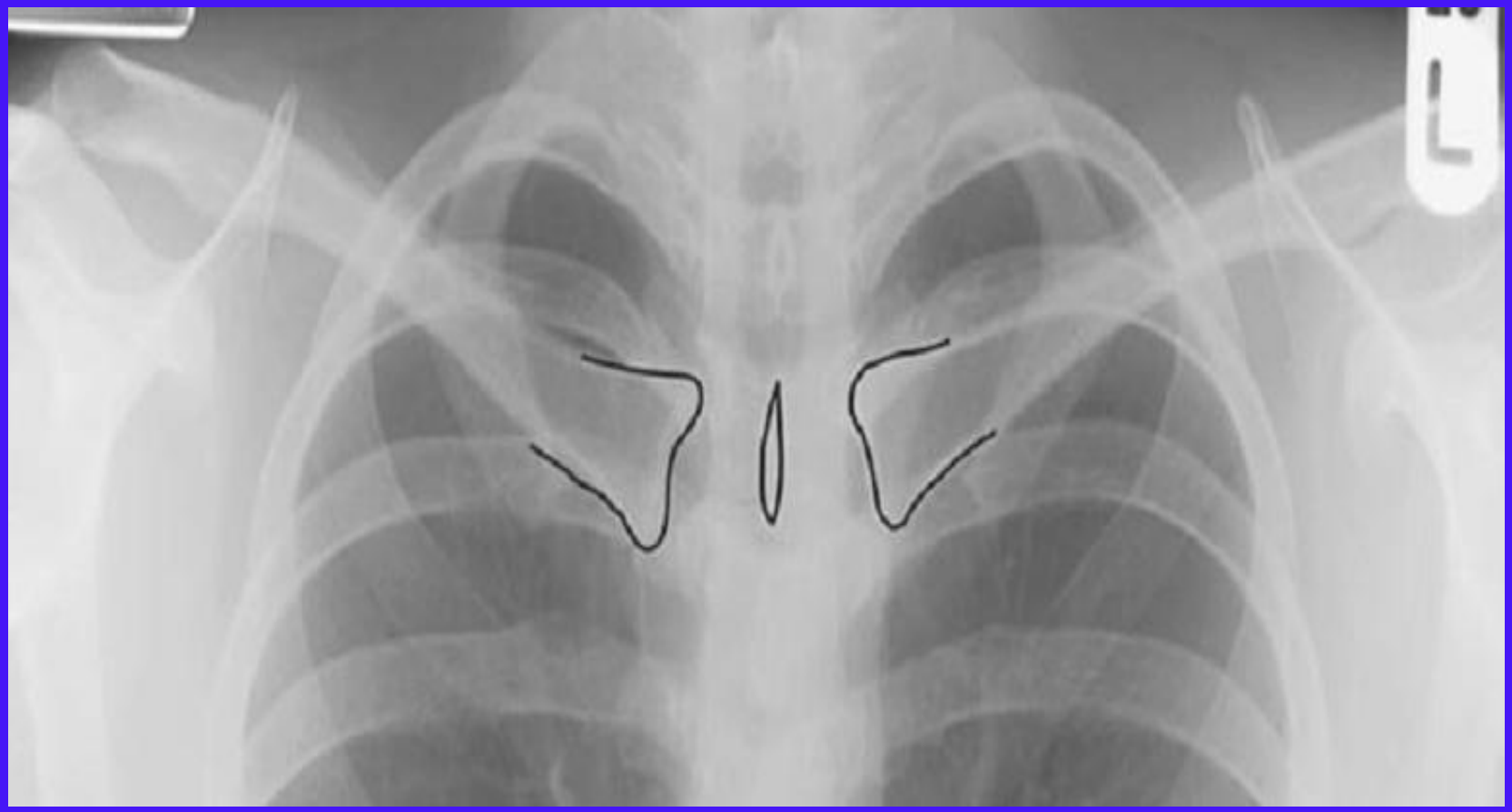


is the trachea is straight and midline?
is there any evidence of narrowing?
is the carina wide (more than 100 degrees)?


RIGHT
Clavicles
Posterior
Spinous processes
Right 5th rib
Anterior

SHIFTING OF TRACHEA

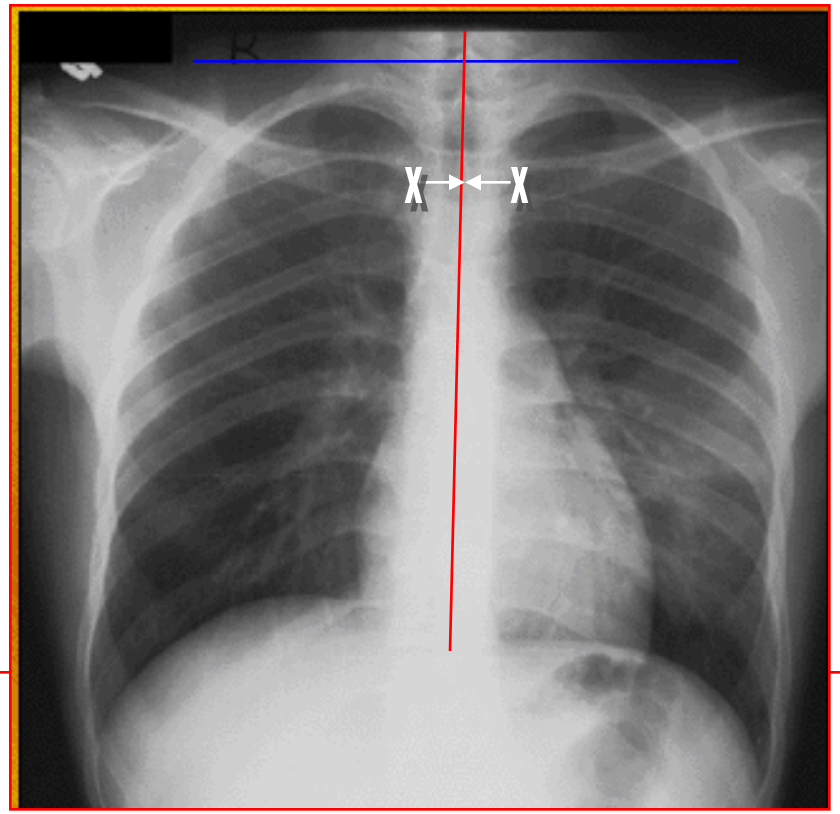
ROTATION

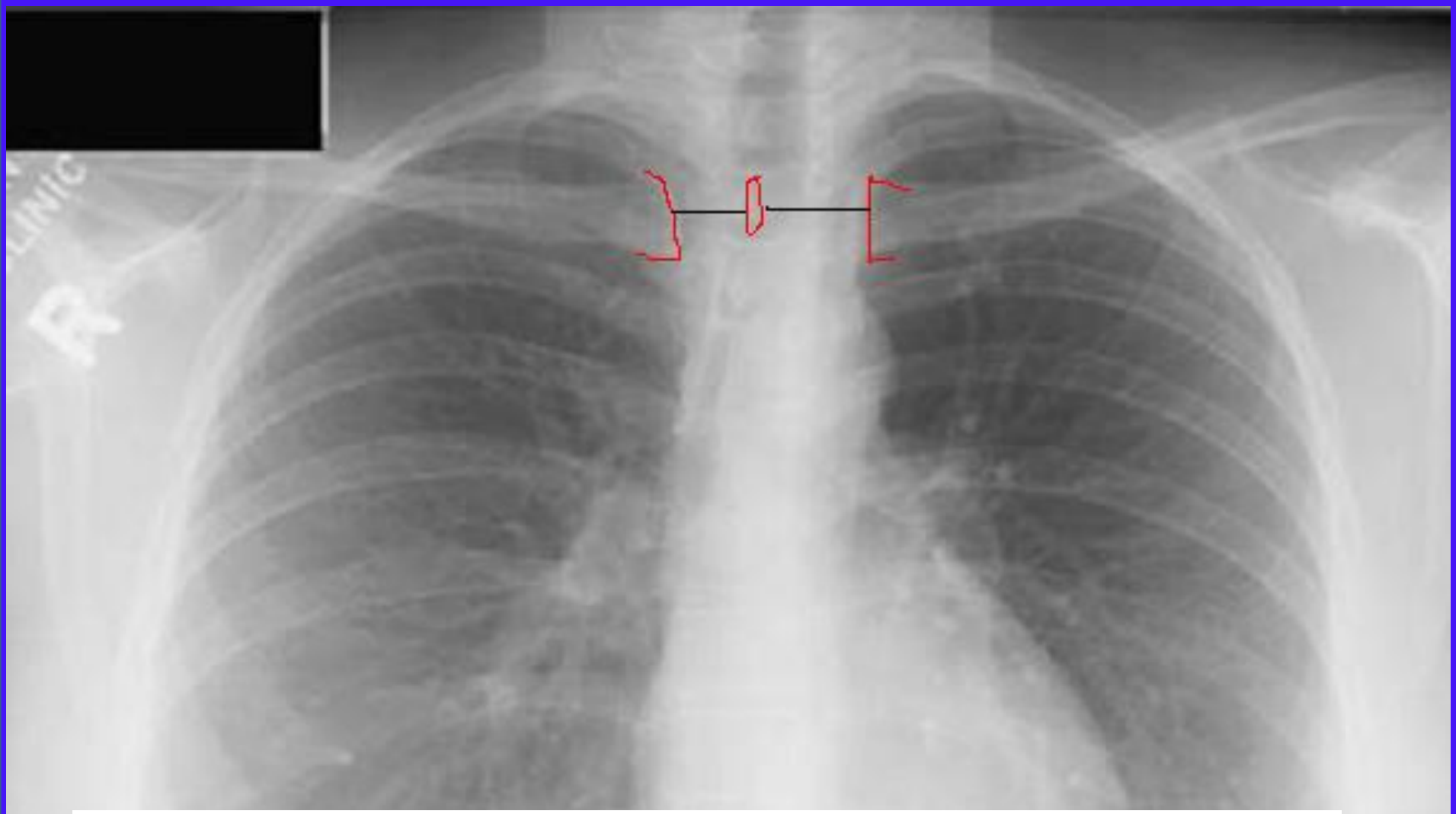


A well centred x-ray. Medial ends of clavicles are equidistant from the spinous process.

Dr. SHAMOL/Radio logy

The patient must Straight (not tilted)(not rotated)

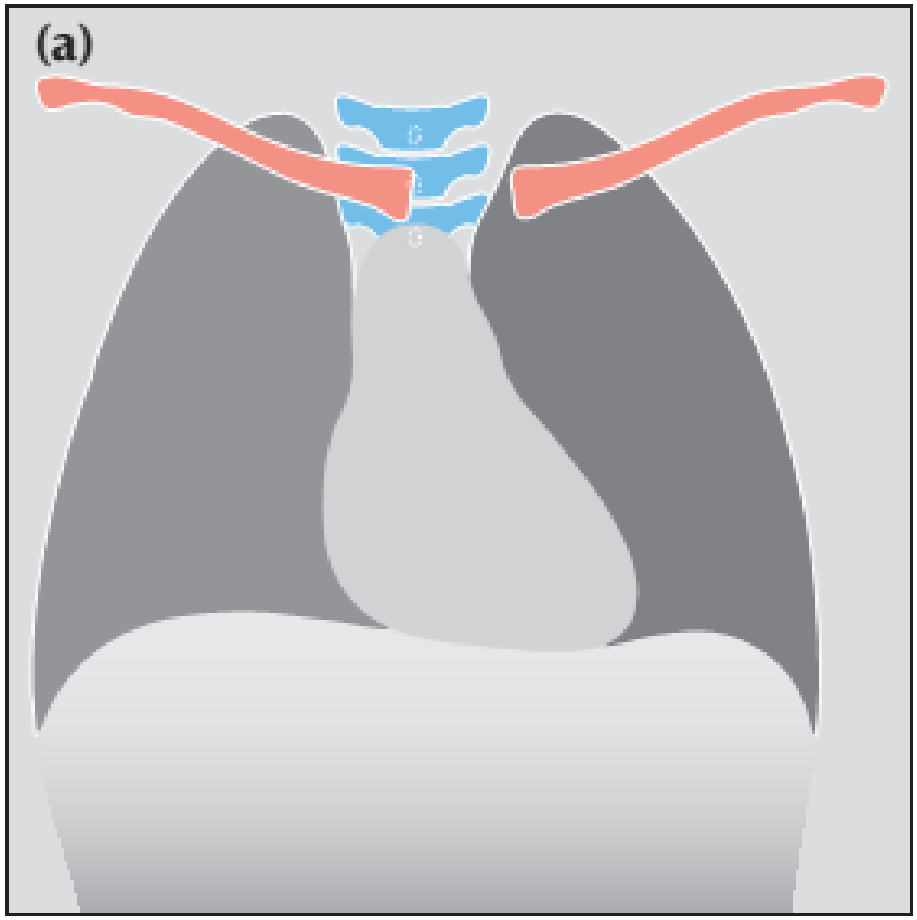


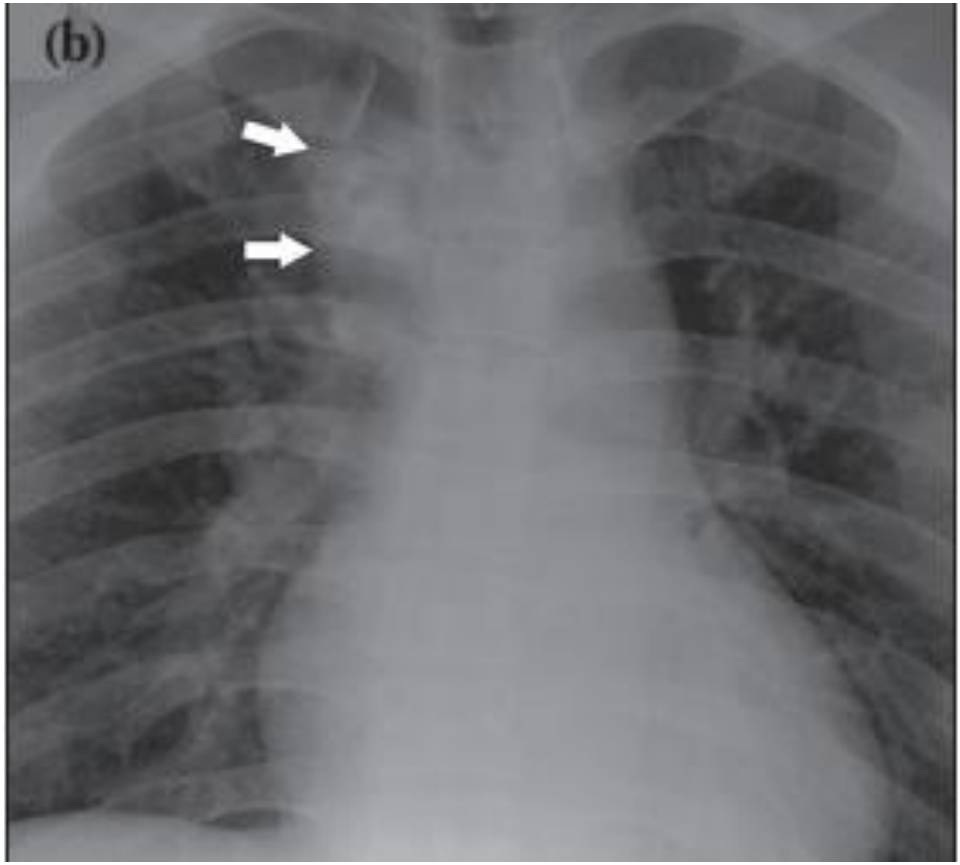


This patient is rotated to the left. Note the spinous process is close to the right clavicle and the left lung is 'blacker' than the right, due to the rotation.

Dr. SHAMOL/Radio logy

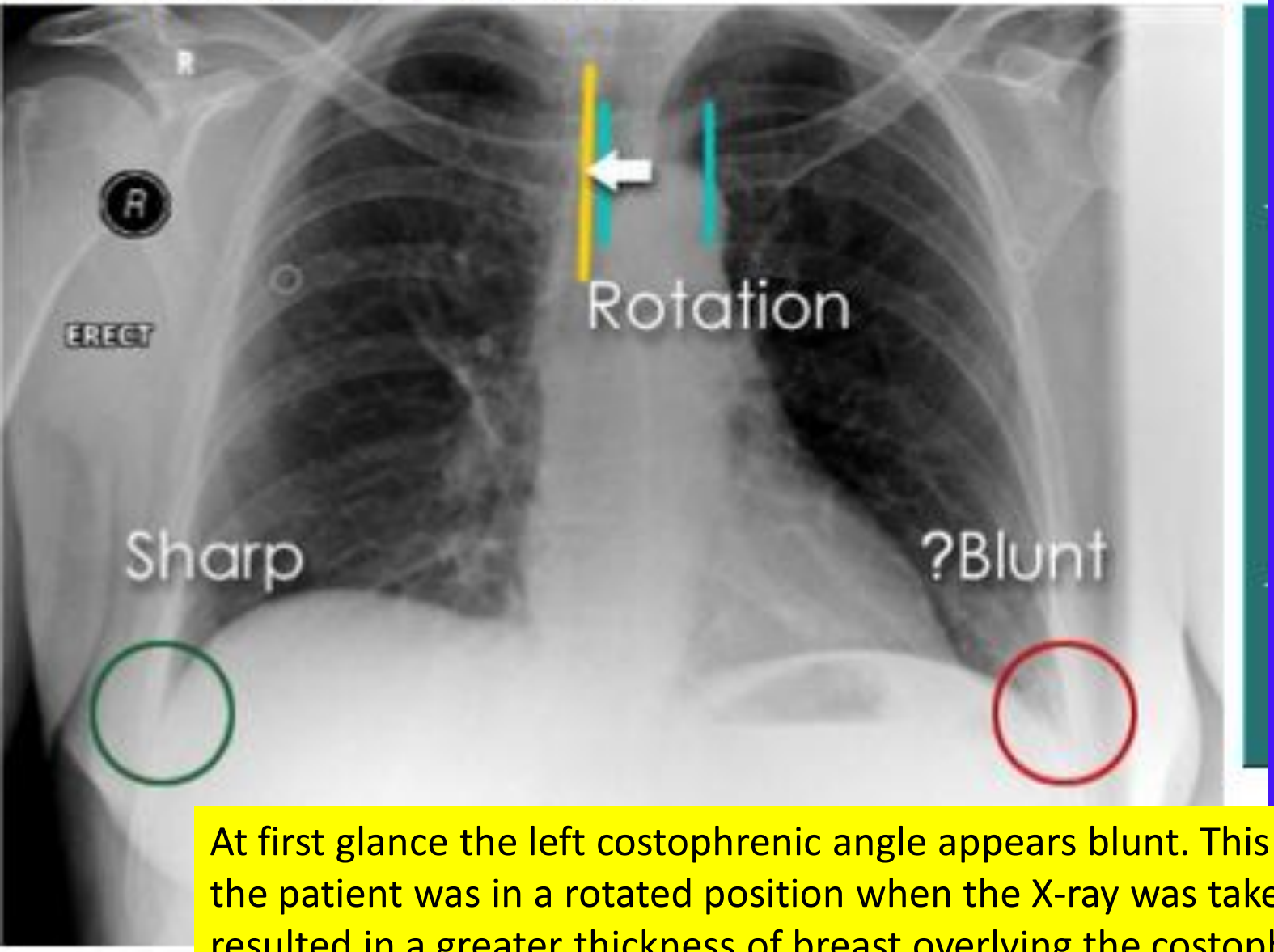
Patient rotation. (a) Rotation to the left.
(b) Male. Age 43. AP CXR. Rotation to the right projects the manubrium and aortic arch vessels (arrows) over the right upper zone, mimicking a mass.





Pseudo-blunting of the costophrenic angle

Hover on/off image to show/hide findings



Dr. SHAMOL/Radio logy

At first glance the left costophrenic angle appears blunt. This is because the patient was in a rotated position when the X-ray was taken. This has resulted in a greater thickness of breast overlying the costophrenic angle on the left, compared to the right.

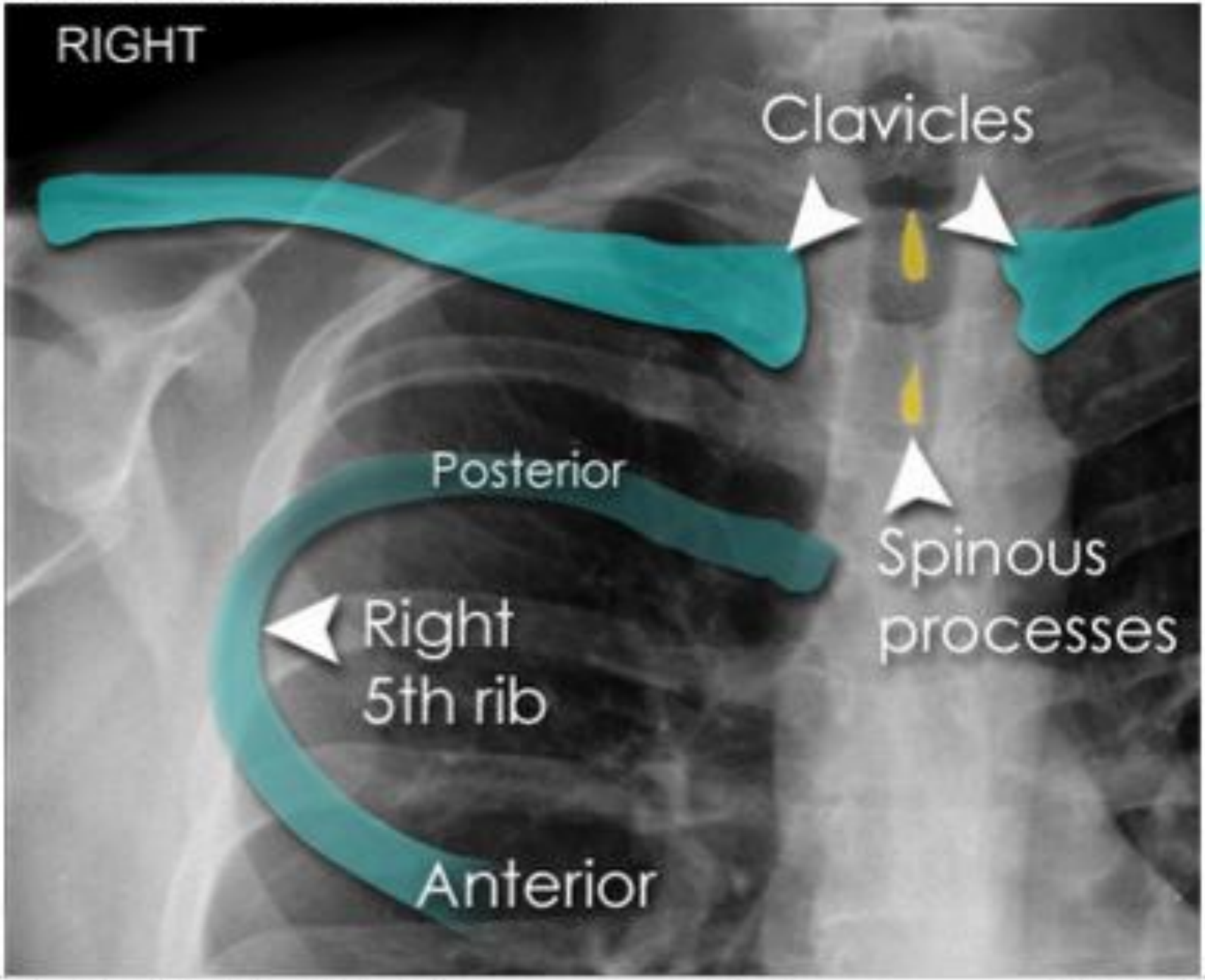
BONEY THORAX

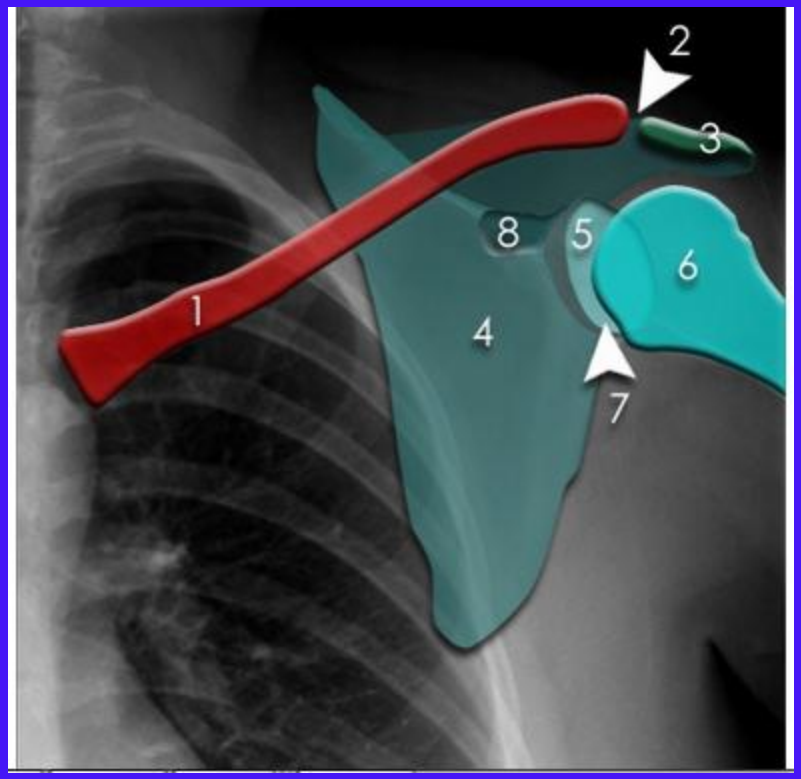
You have to identify the anterior and posterior end of rib

Clavicle end

Scapula

Cervical rib


RIGHT
Clavicles
Posterior
Spinous processes
Right 5th rib
Anterior



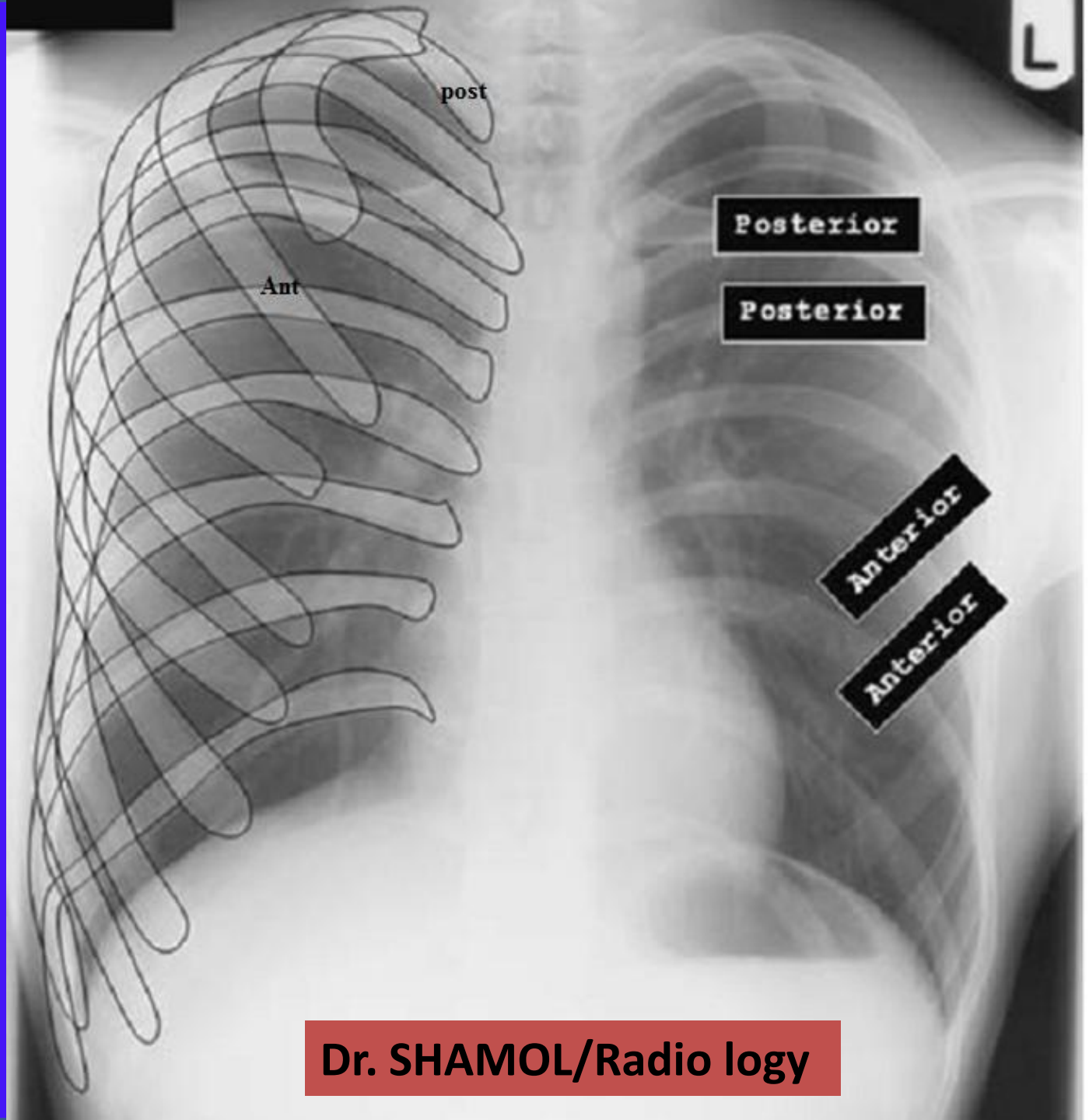
lavicle, scapula, and humerus

The clavicle, scapula and humerus are often clearly seen on a chest X-ray. Occasionally you will see evidence of important disease such as metastases in these bones.

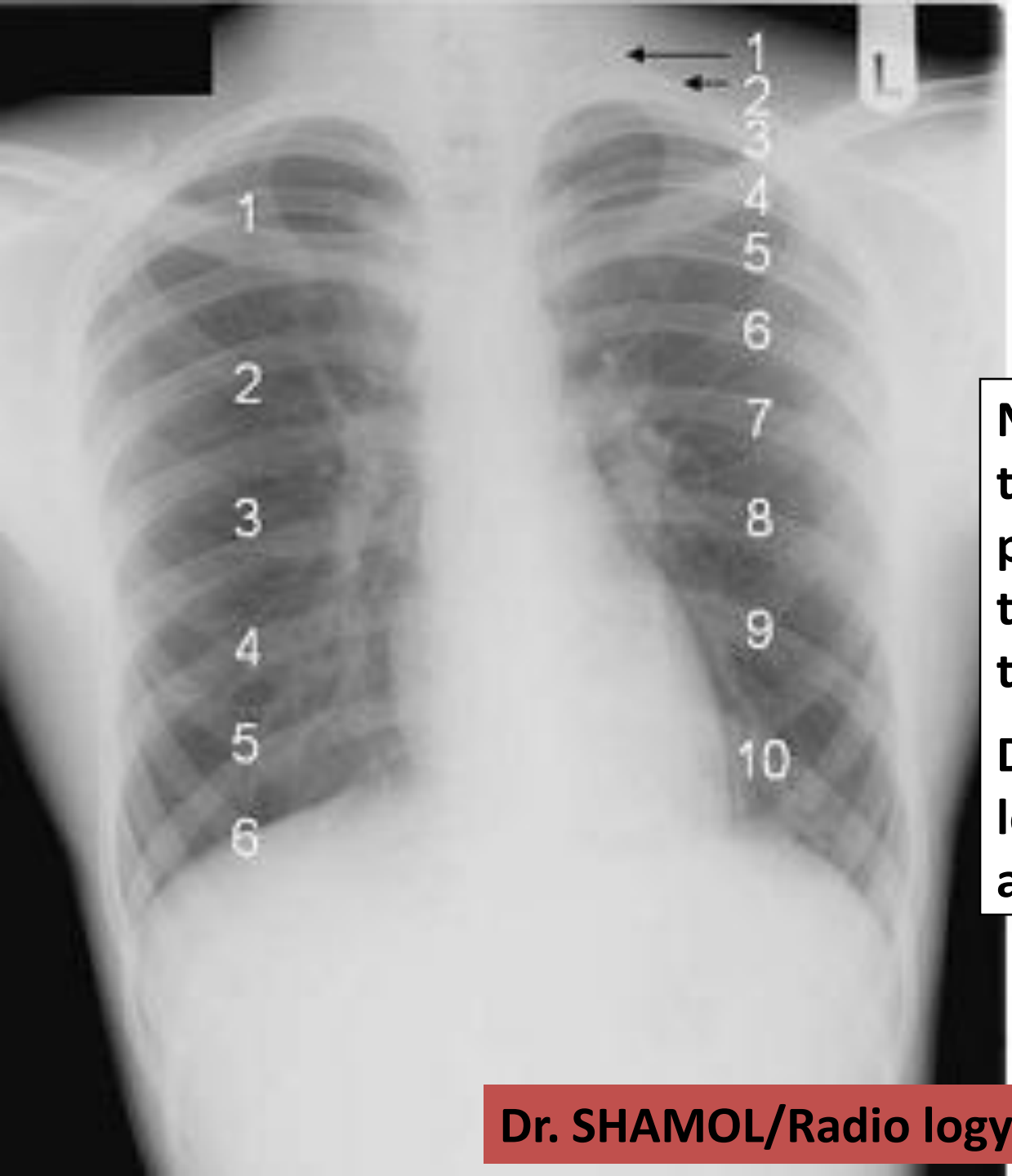
Key

1 - Clavicle
2 - Acromioclavicular joint
3 - Acromion process of scapula
4 - Body of scapula
5 - Glenoid fossa of scapula
6 - Head of left humerus
7 - Glenohumeral joint
8 - Coracoid process of scapula

Dr. SHAMOL/Radio logy



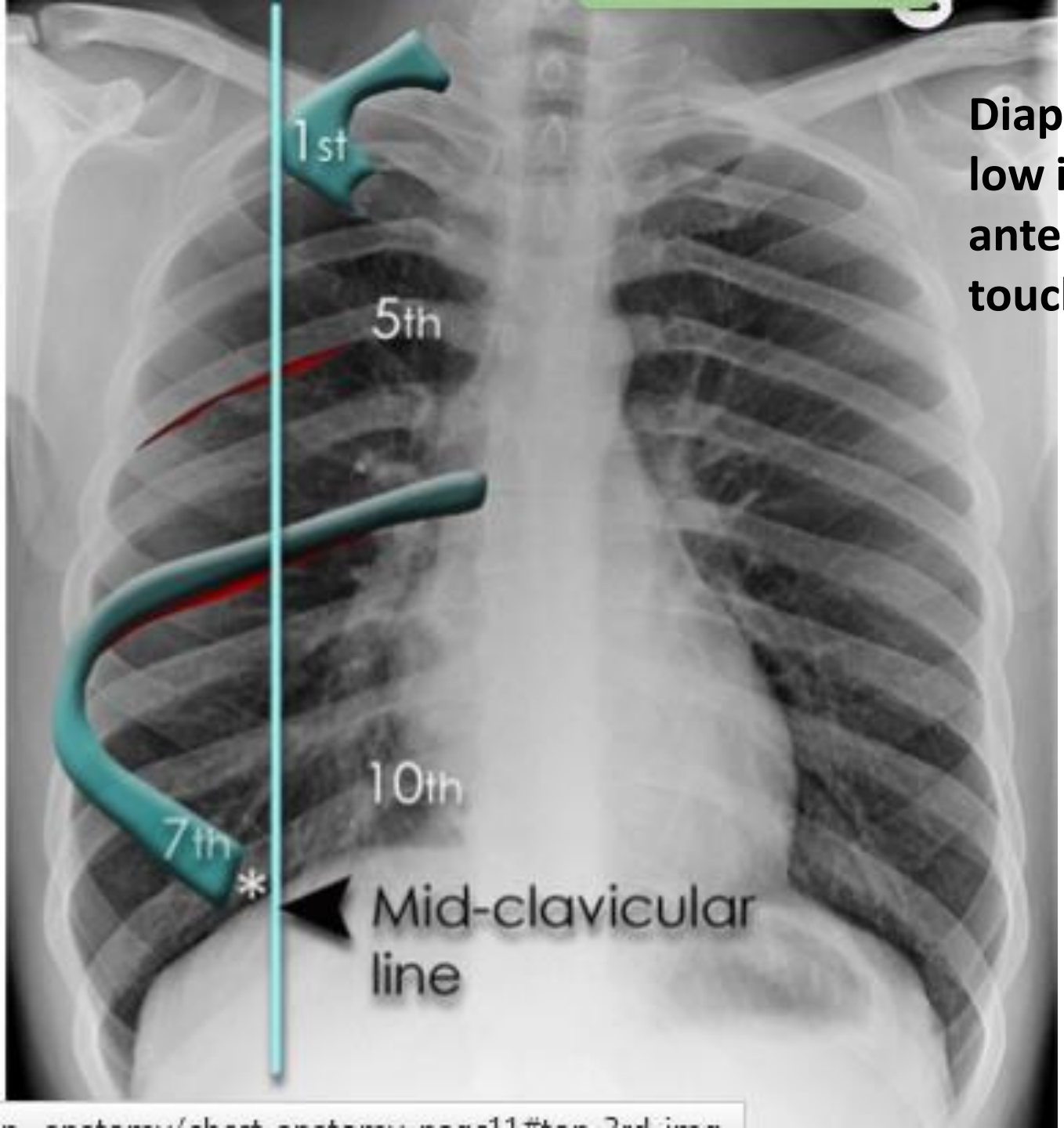
Dr. SHAMOL/Radio logy



Normally ant end of 6th touch the diaphragm and post end of 10 th rib touch the diaphragm touch at diaphragm

Diaphragm will be told low if 7 th rib touch ant and 11 th rib touch post

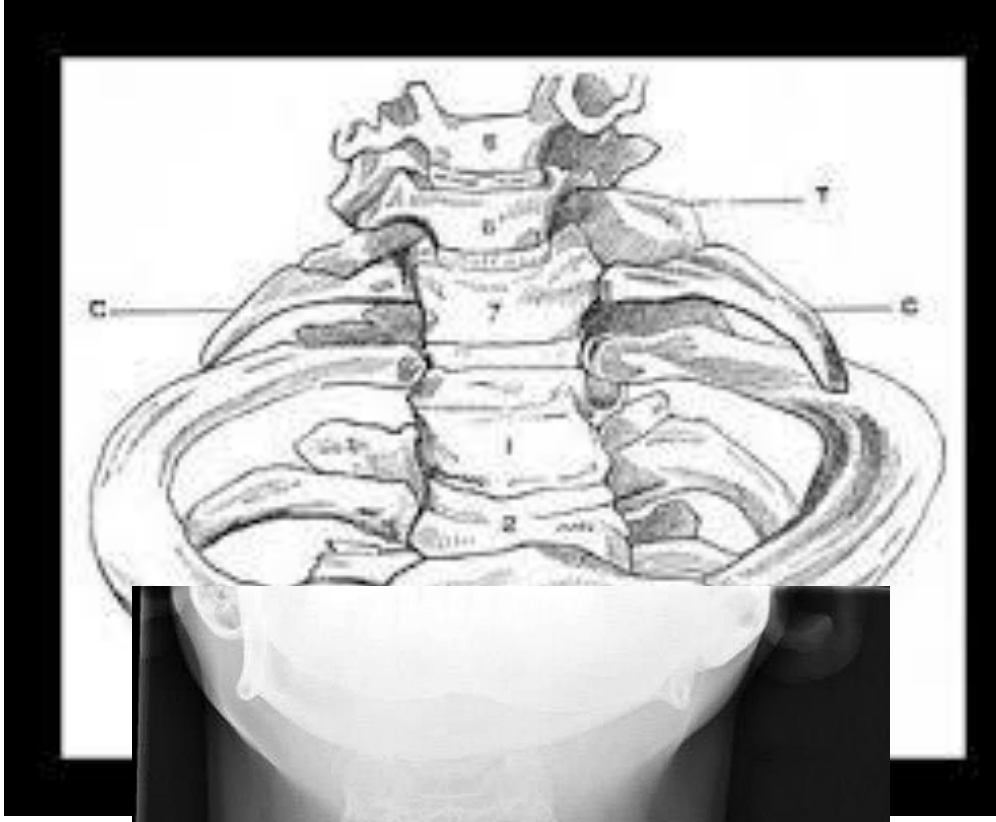
Dr. SHAMOL/Radio logy

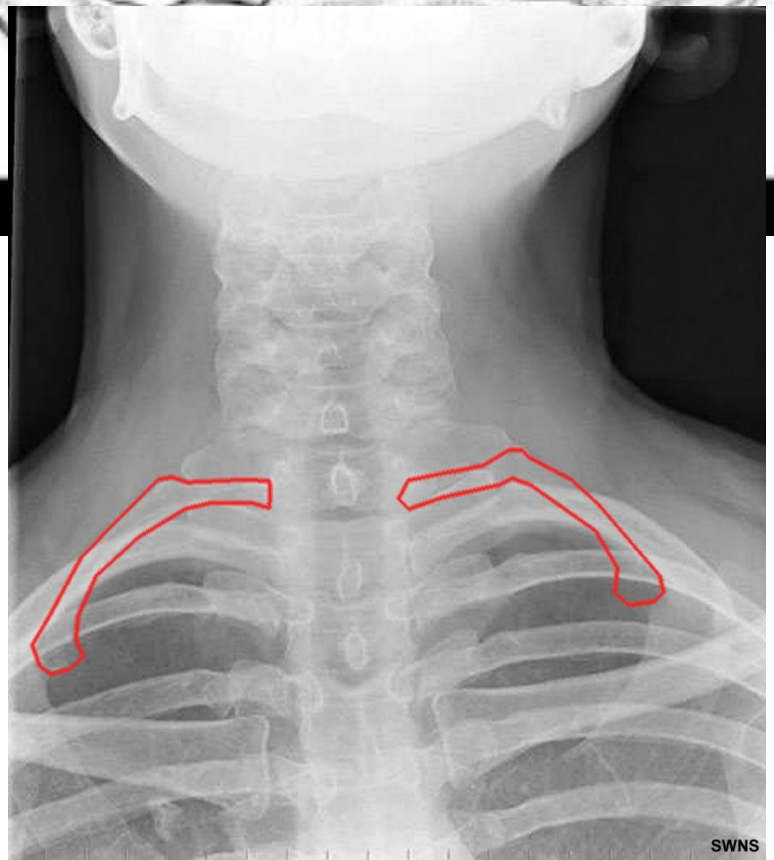


Diaphragm will be told low if 7 th rib touch anteriorly and 11 th rib touch posteriorly

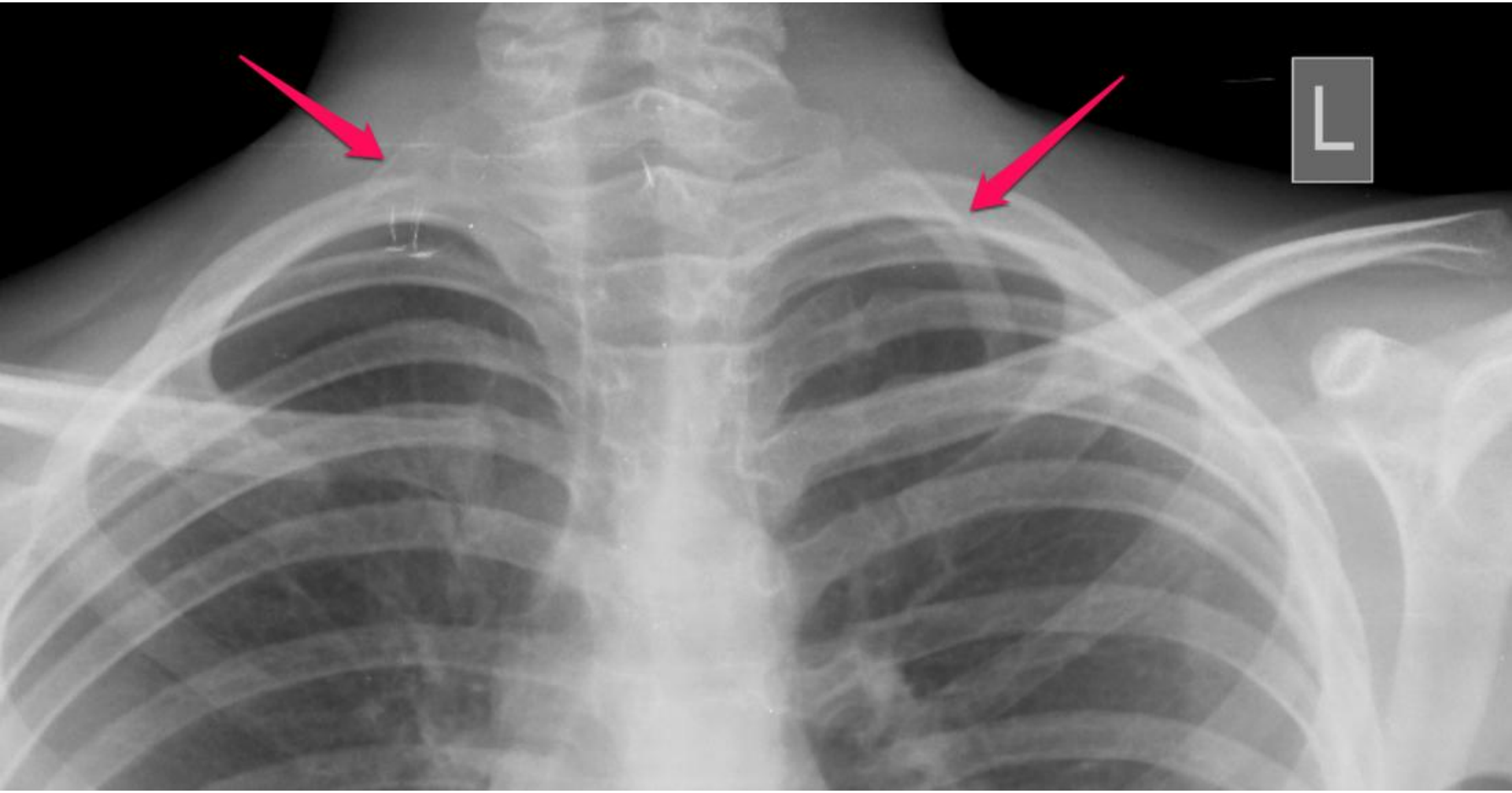


Figure-1: Left Cervical Rib and Right transversomegaly.





Cervical rib


L

BEFORE COMMENT THE X-RAY
SEE IT IS IN INSPIRATORY OR EXPIRATORY FILM

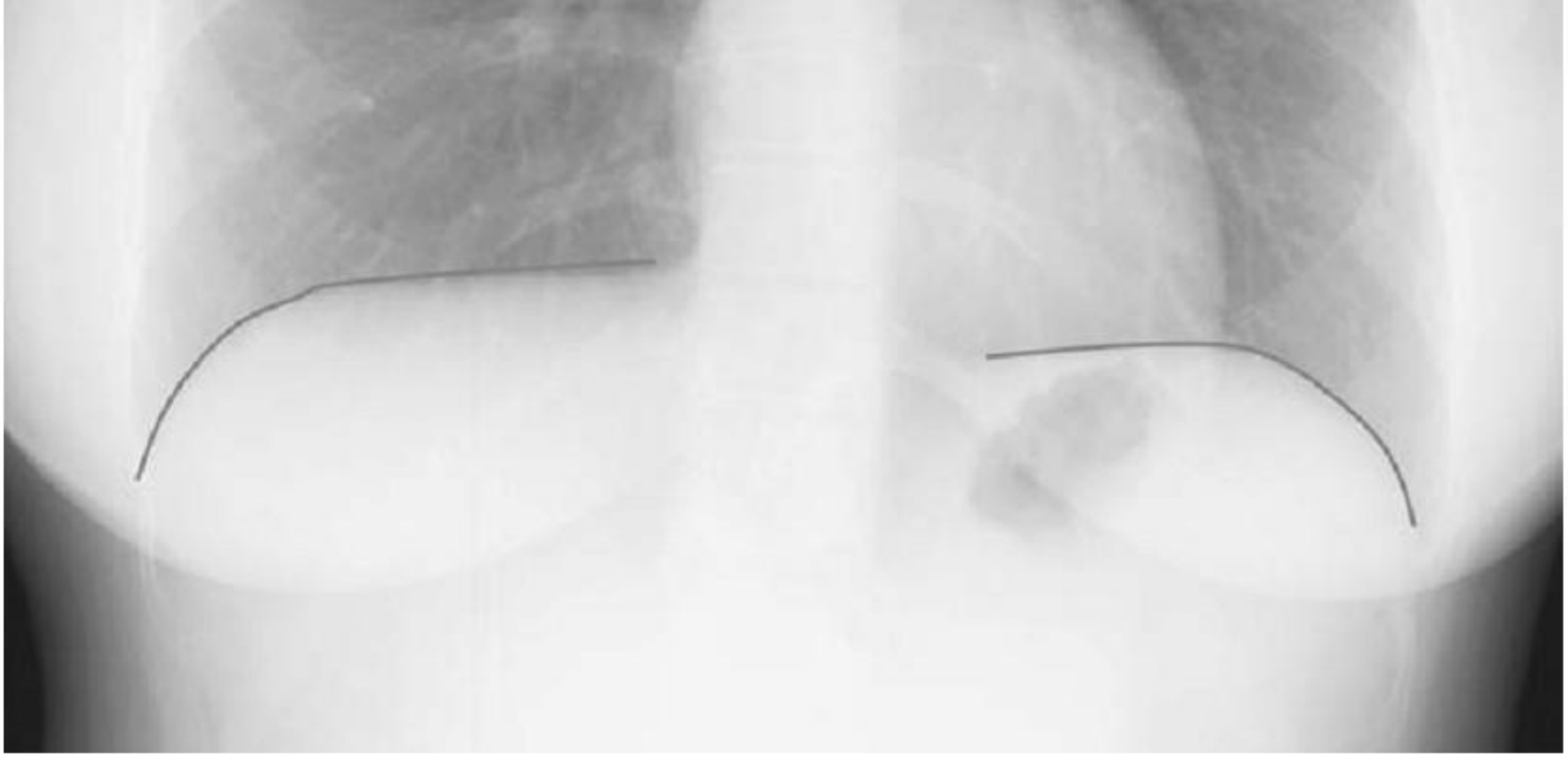


An example of poor inspiratory effort. Only four complete anterior ribs are visible. This results in several spurious findings: cardiomegaly, a mass at the aortic arch and patchy opacification in both lower zones



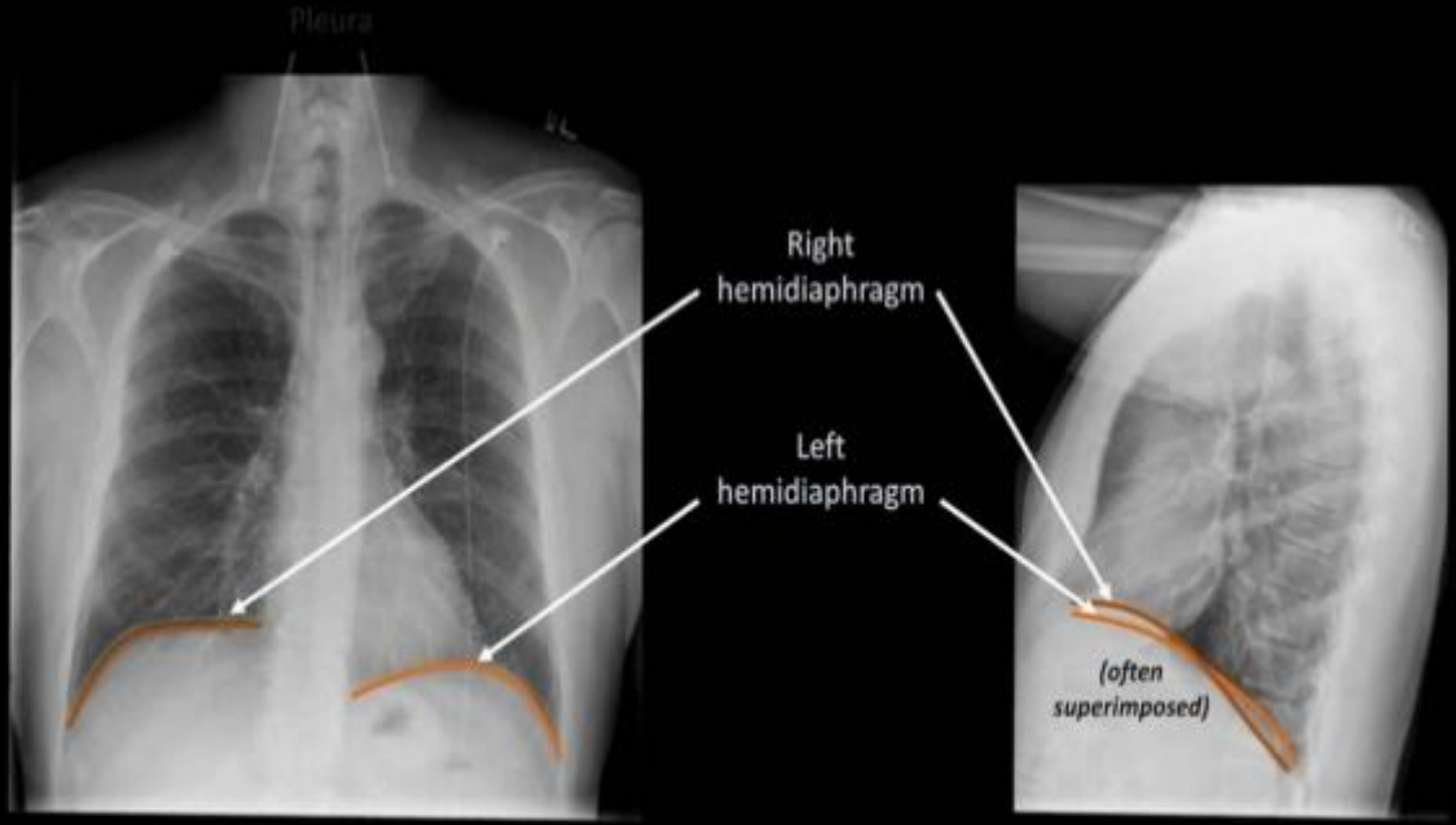
Same patient following an adequate inspiratory effort. The CXR now appears normal.

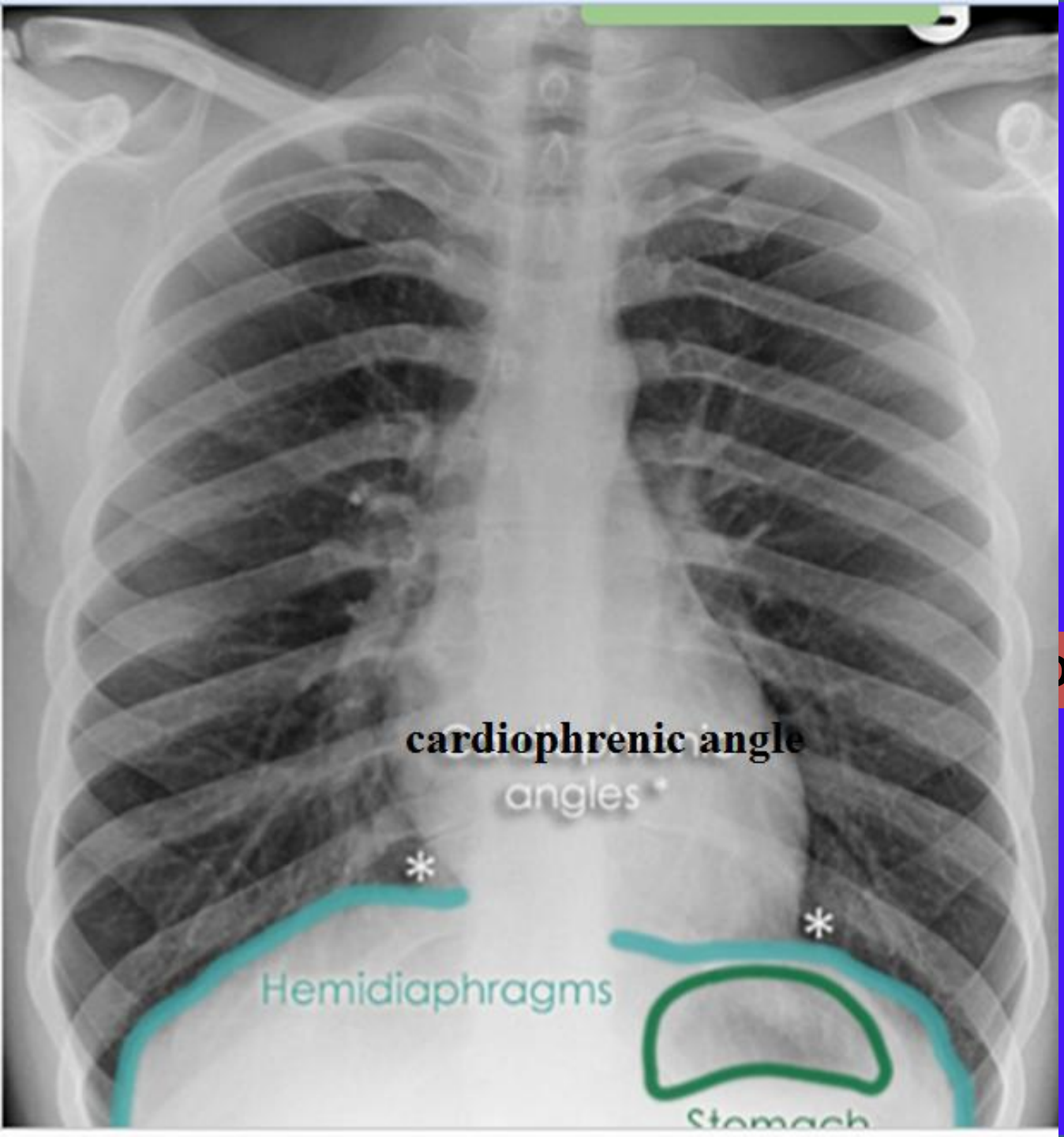
Identify
the diaphragm
Costo and cardiophrenic angle
Which diaphragm is higher
Low and flat diaphragm
Diaphragm is elevated or not



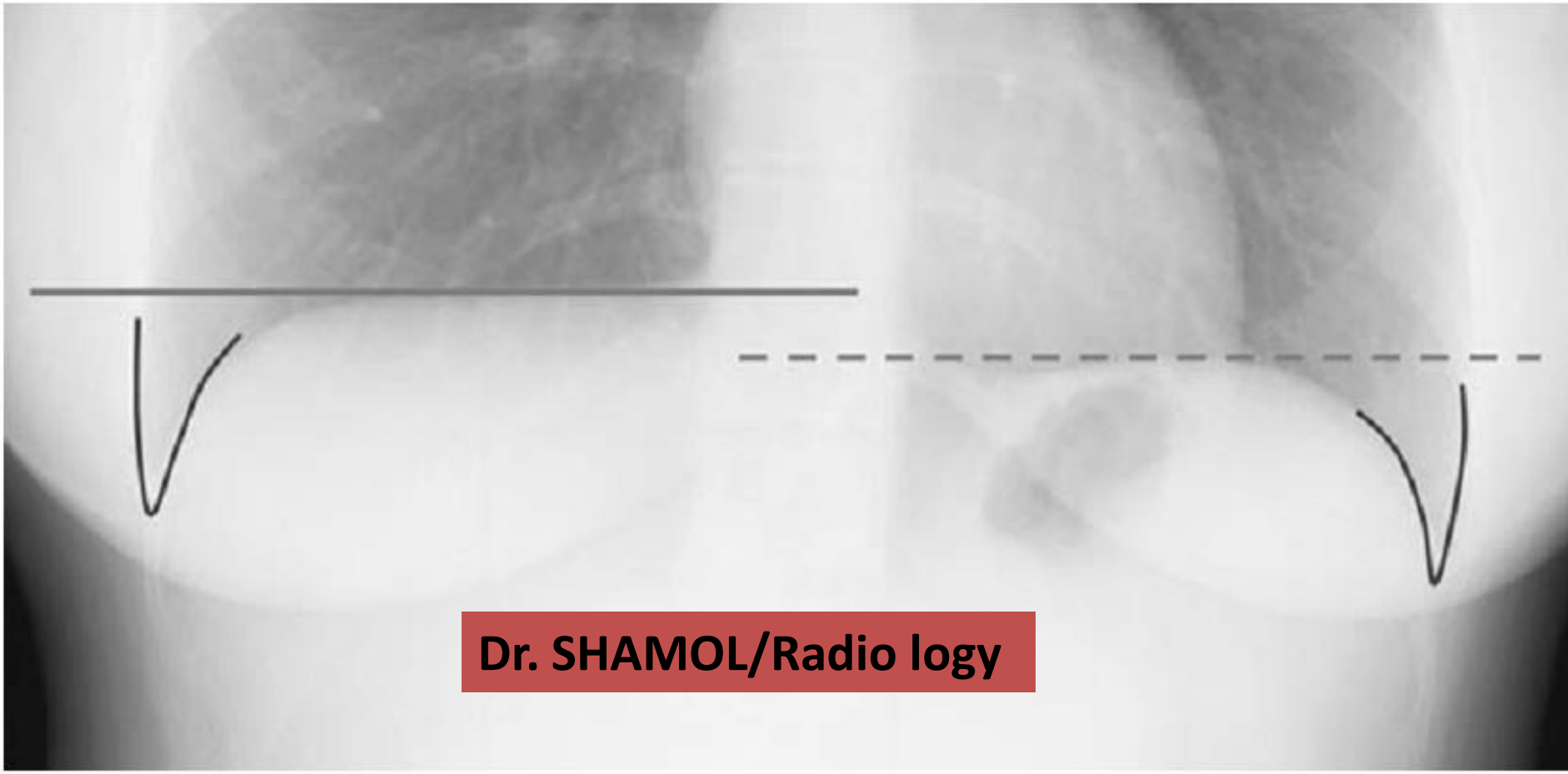
The outlines of both hemidiaphragms should be clearly visible.

Anatomy – Diaphragm and Pleura



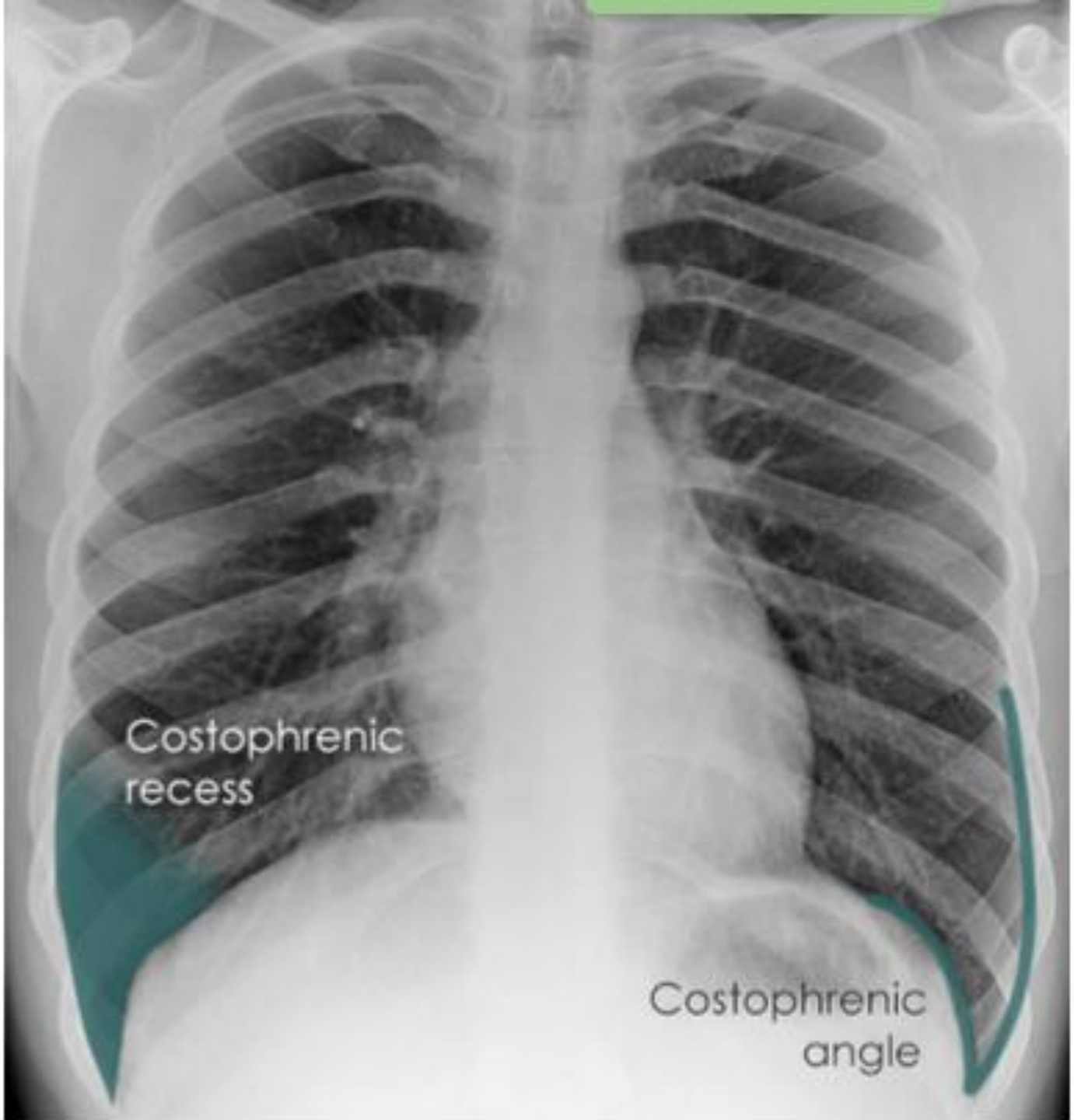


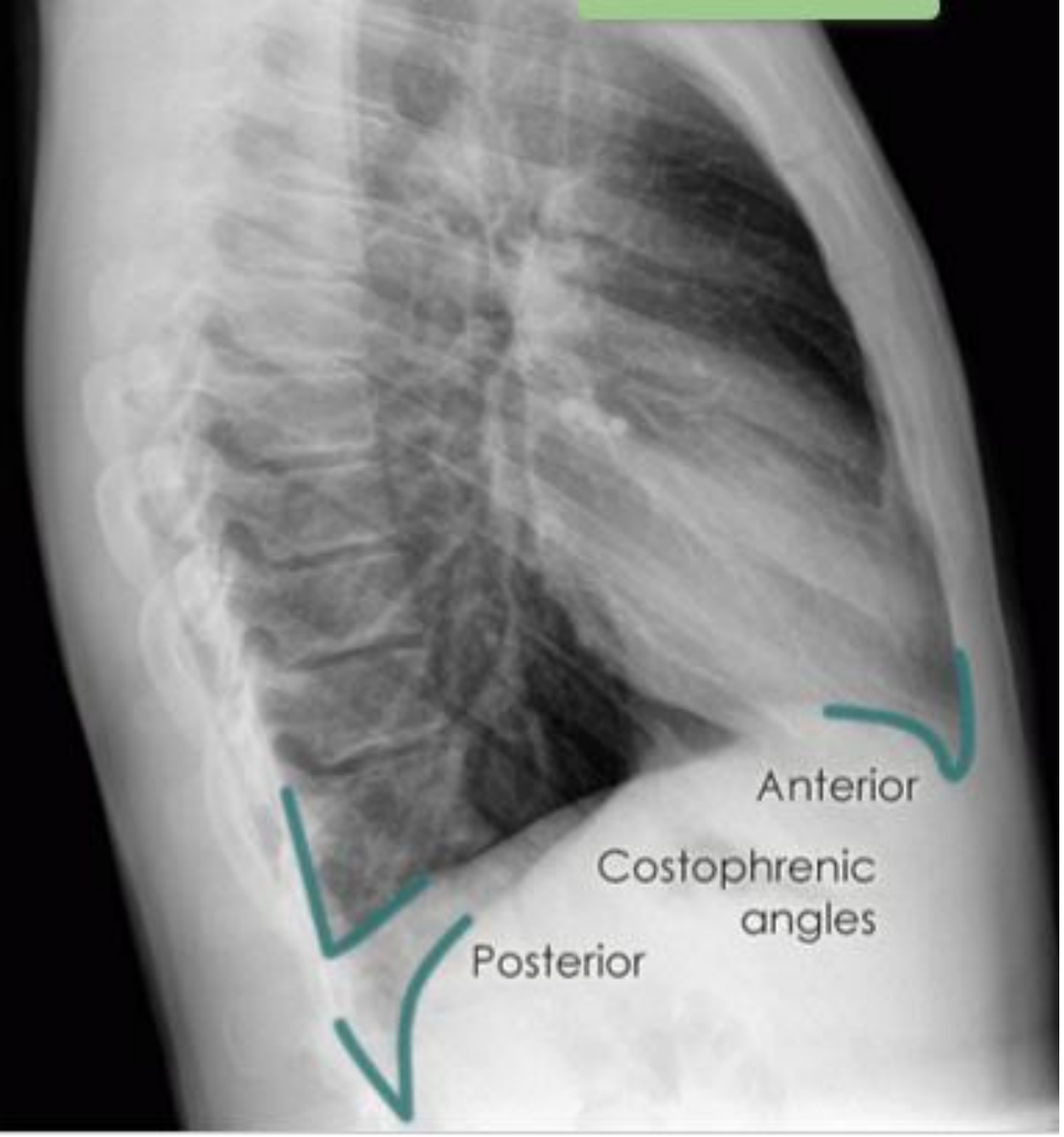
Dr. SHAMOL/Radio logy



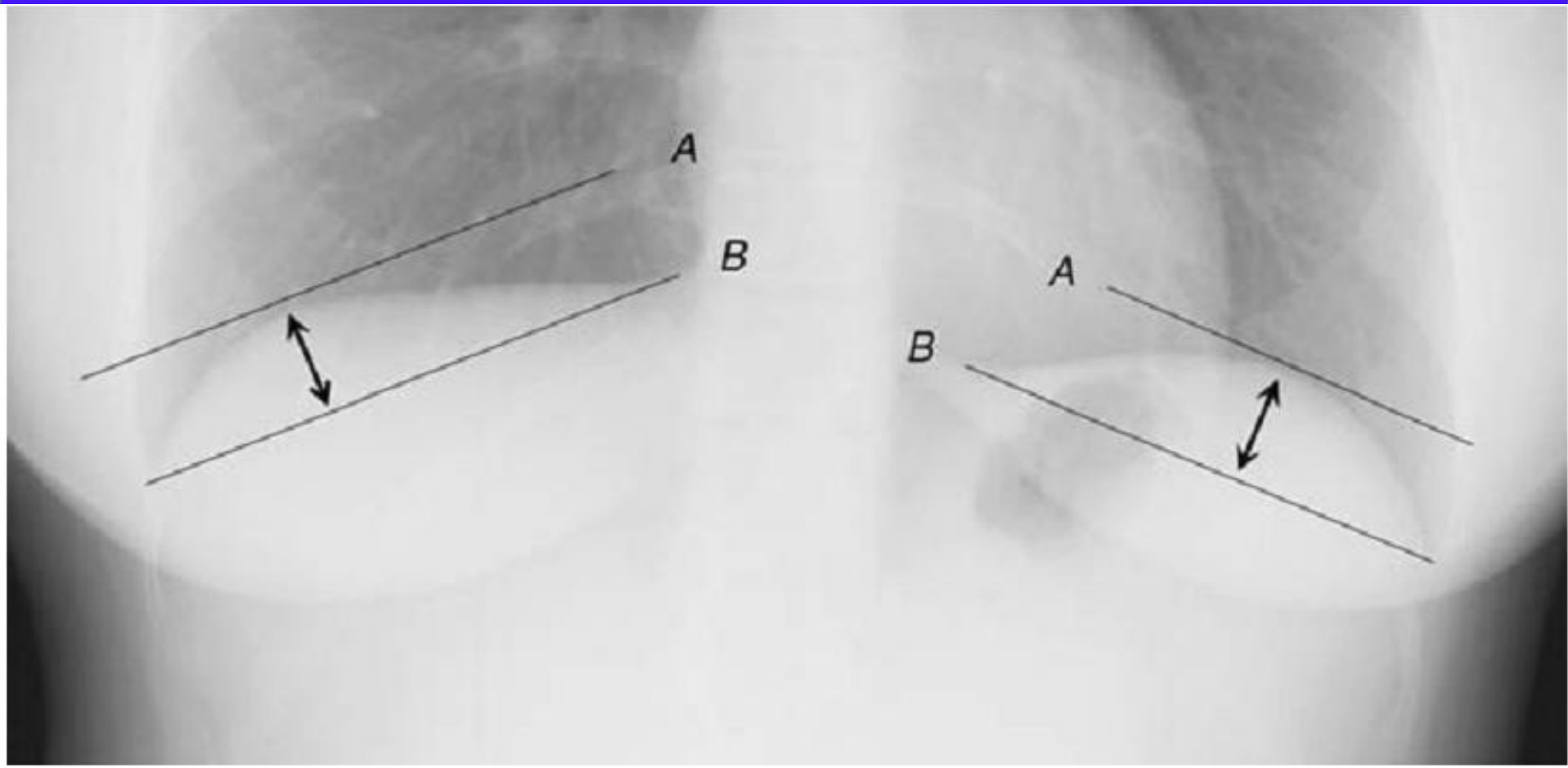
The right hemidiaphragm is 'higher' than the left. Both costophrenic angles are sharply outlined.

Carefully examine each diaphragm. The highest point of the right diaphragm is usually 1–1.5 cm higher than that of the left. Each costo-phrenic angle should be sharply outlined. The outlines of both hemidiaphragms should be sharp and clearly visible along their entire length (except the medial most aspect of the left hemidiaphragm).


Costophrenic
recess
Costophrenic
angle

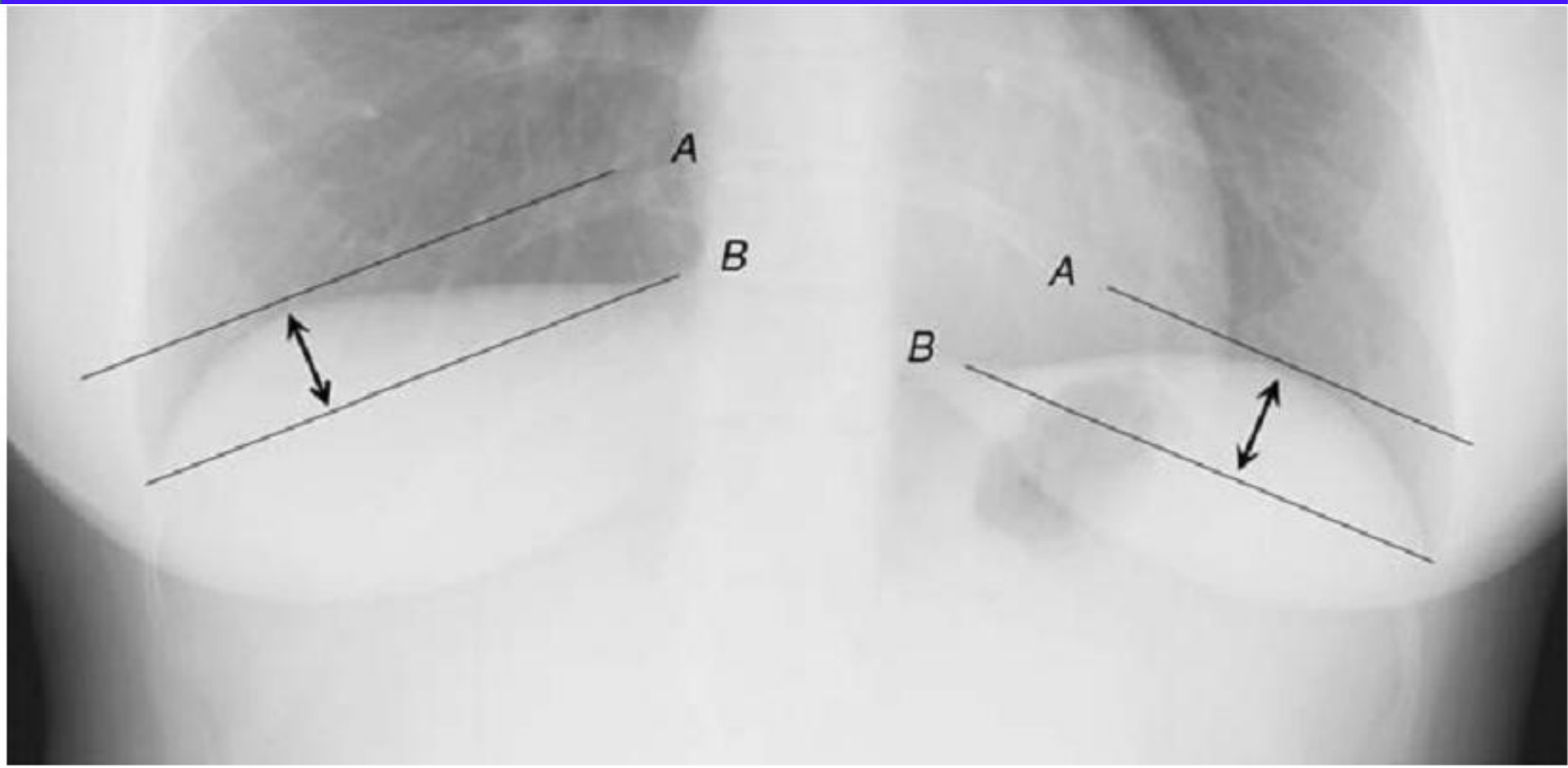


On a lateral view the costophrenic recesses are seen in the region of the anterior and posterior costophrenic angles formed by the chest wall and the dome of each hemidiaphragm



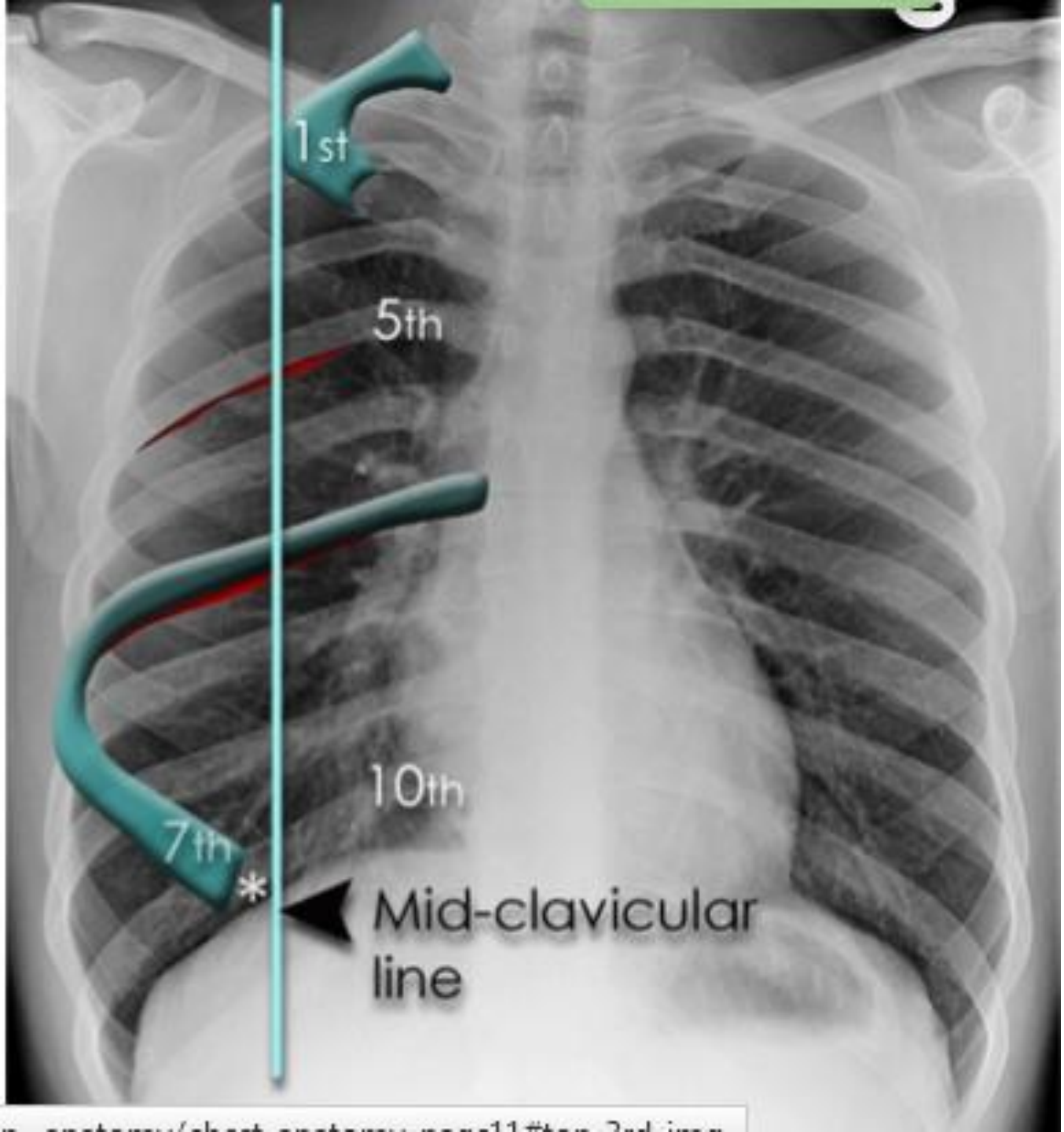
Assess for diaphragmatic flattening. The distance between *A* and *B* should be at least 1.5 cm.

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Assess for diaphragmatic flattening. The distance between *A* and *B* should be at least 1.5 cm.

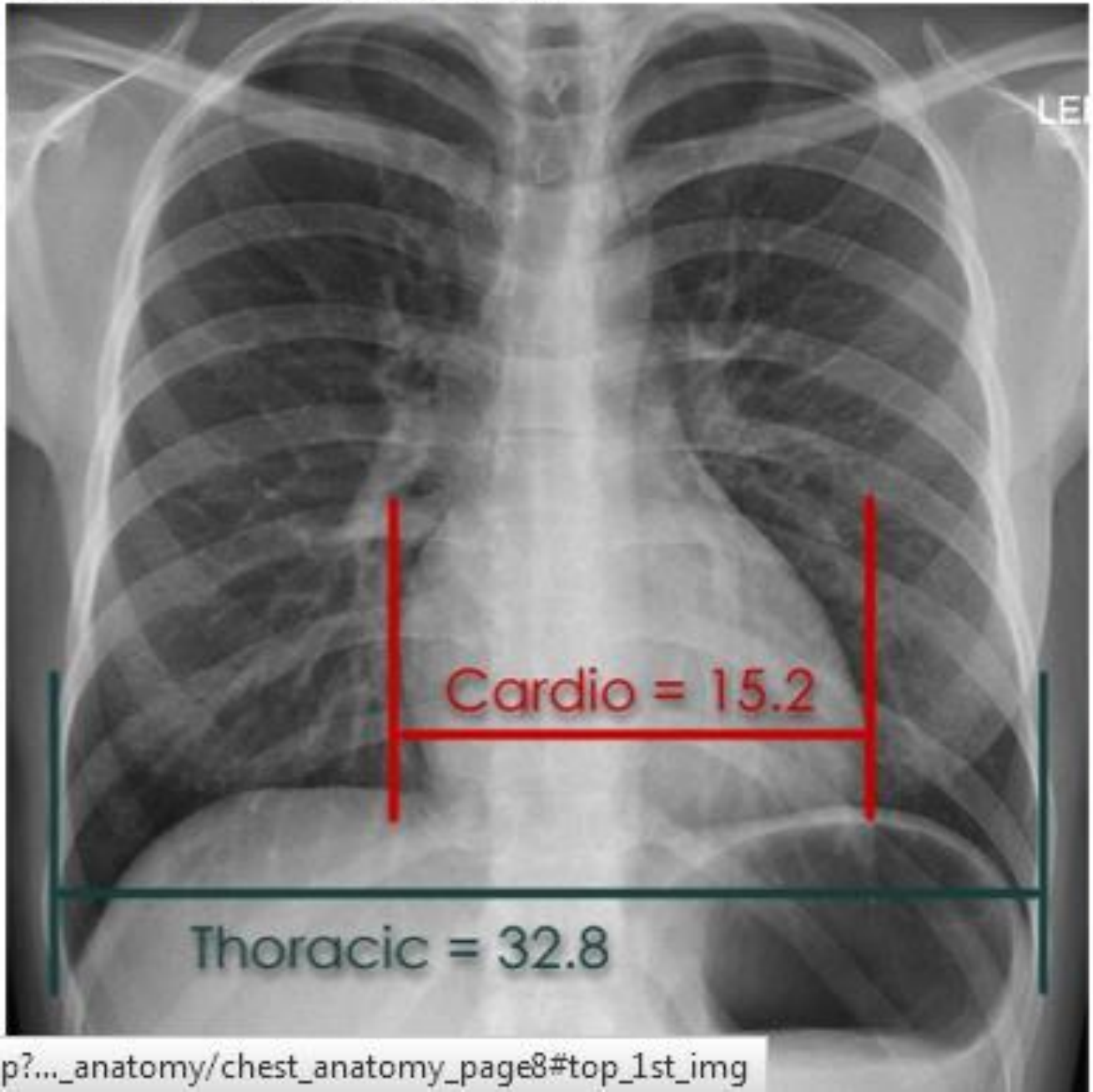
Dr. SHAMOL/Radio logy

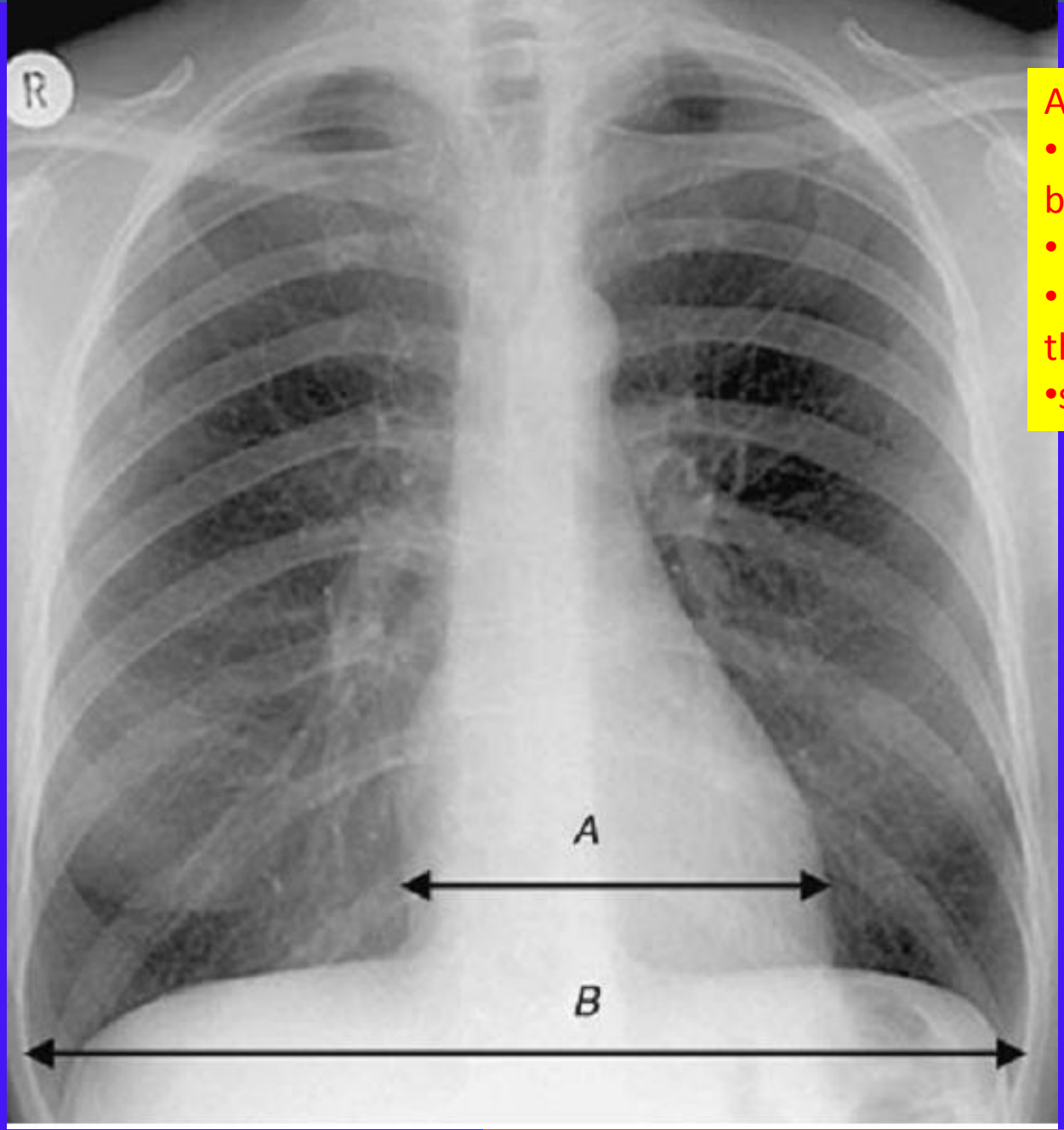

1st
5th
10th
7th
*
Mid-clavicular
line

Identify cardiomegaly
LV—type enlargement
RV-type enlargement

Cardiothoracic ratio (CTR)

Hover on/off image to show/hide findings

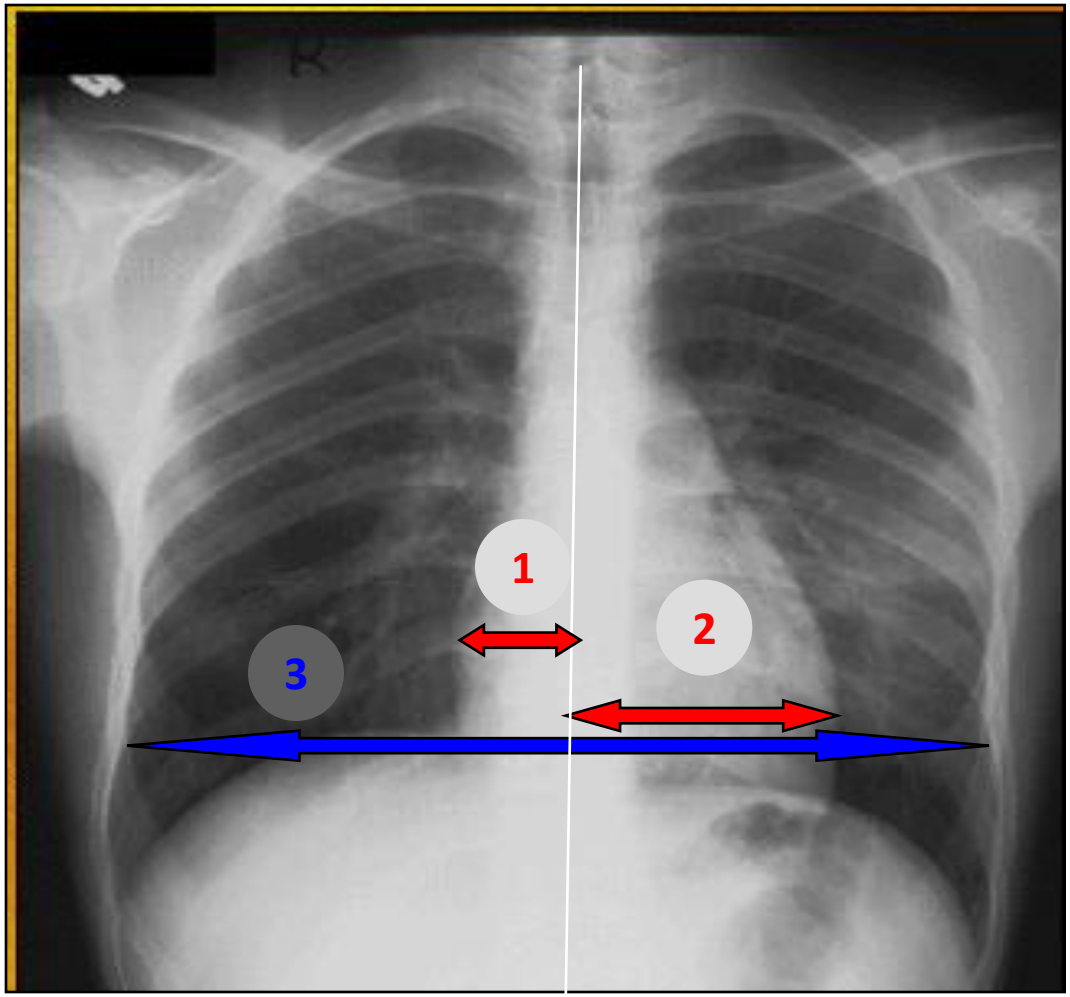




Assessment of heart size

- The cardiothoracic ratio should be less than 0.5.
- i.e. A/B<0.5.
- A cardiothoracic ratio of greater than 0.5 (in a good quality film)
- suggests cardiomegaly.

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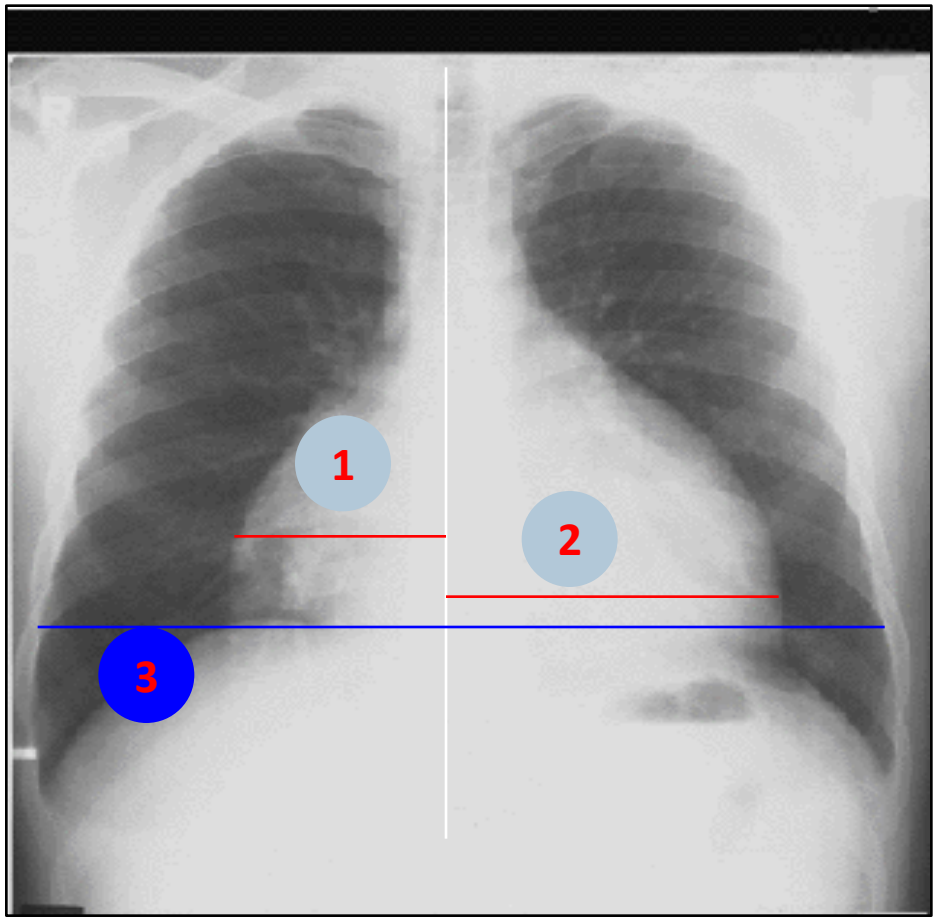


SIZE

CARDIAC DIAMETER (1+2) / =50-55%

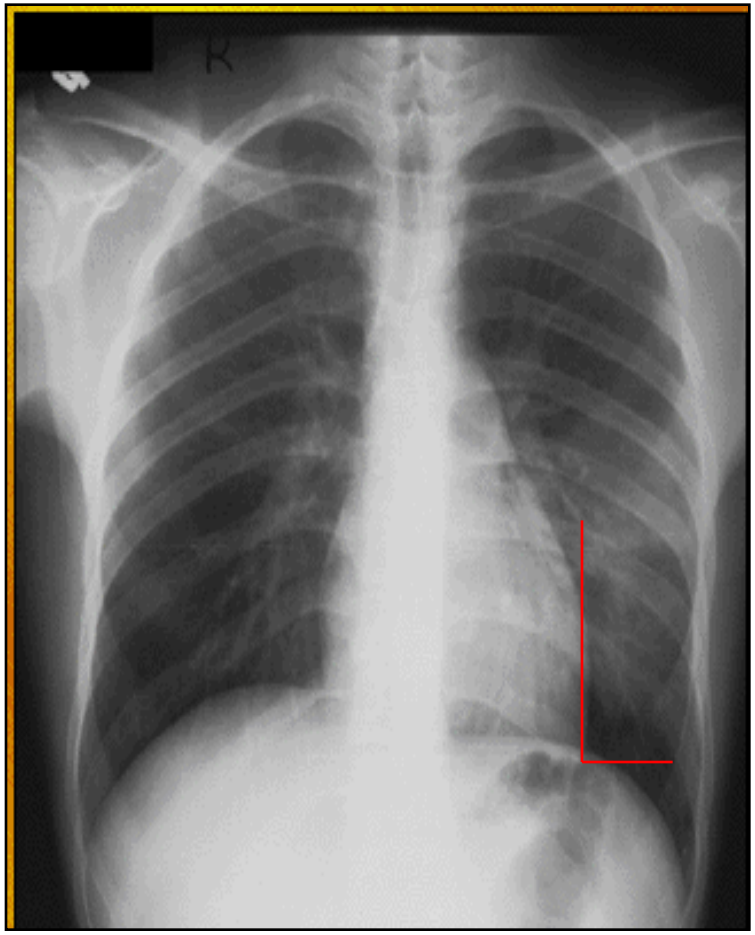
4+6=10)/20=50%(

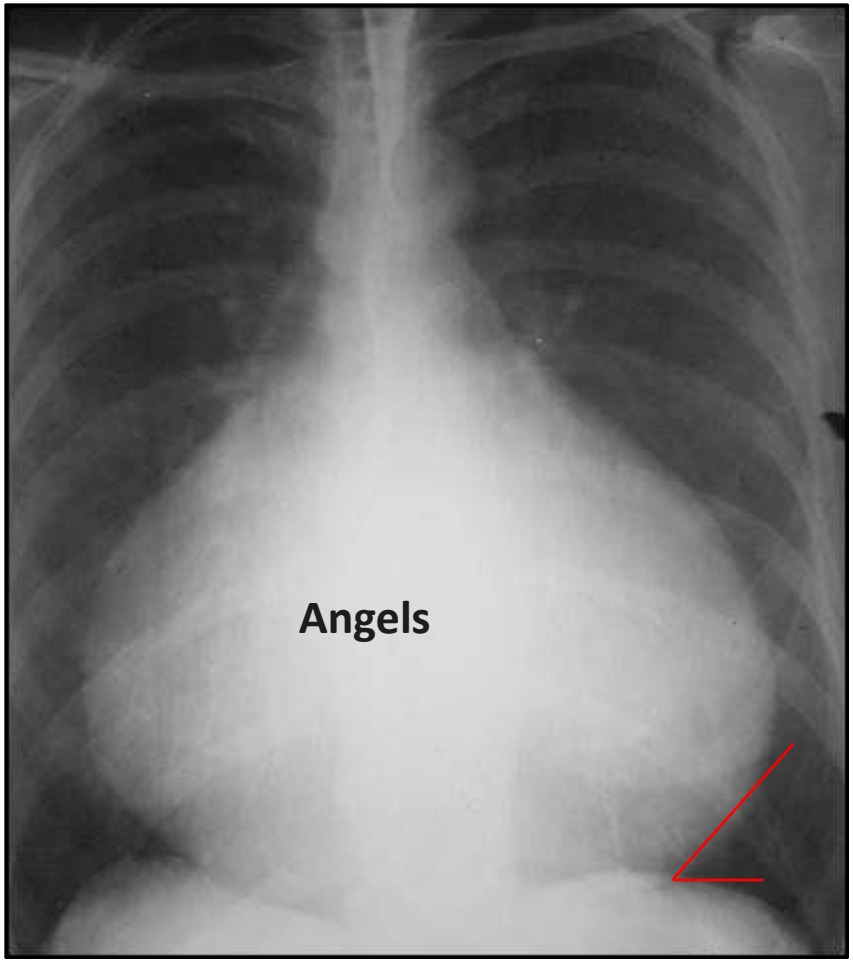
Cardiomegaly

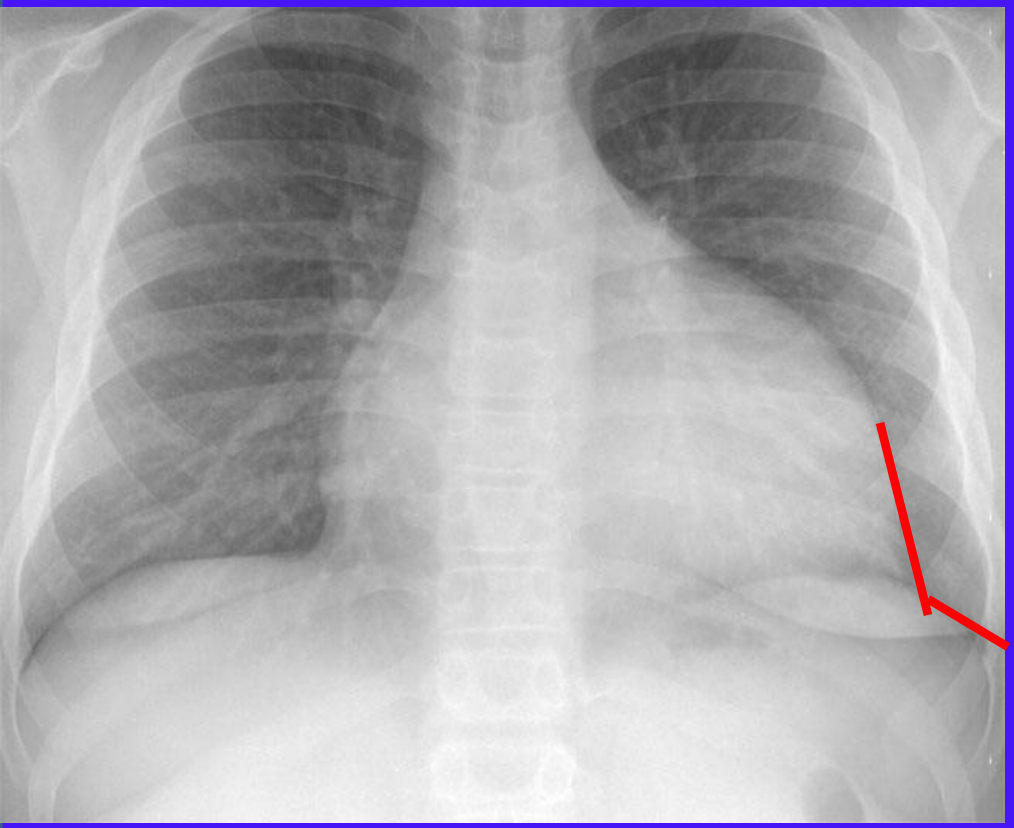


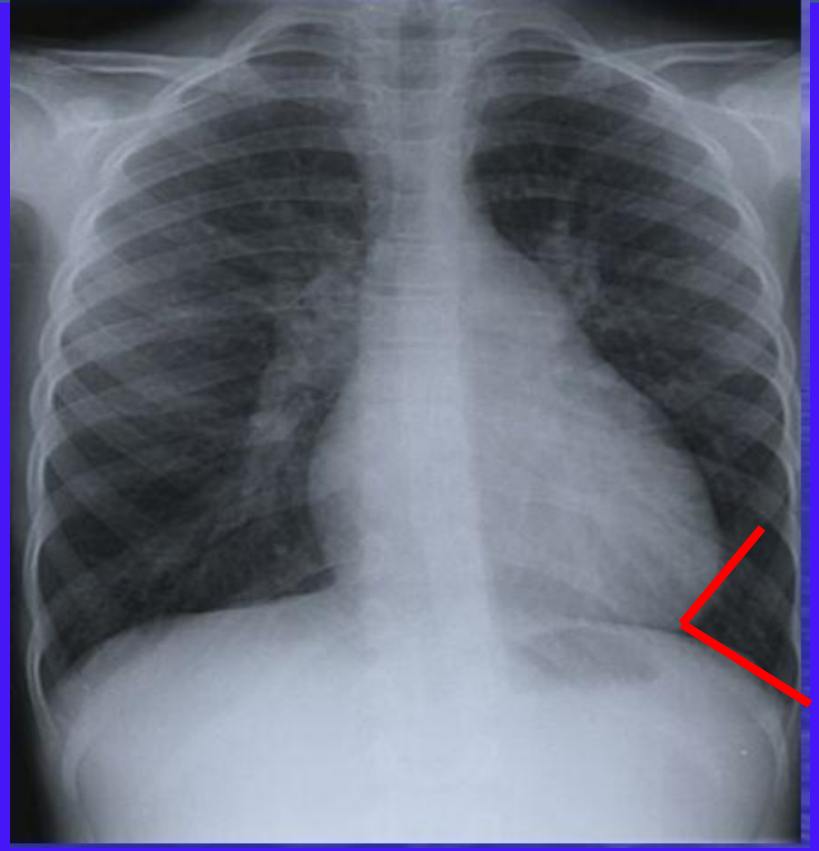
5+7=12)/20=60%(

Angle of the heart









Left ventricular hypertrophy produces rounding of the left heart **border A View: lateral and downward displacement of the cardiac apex and angle is more than 90^0**

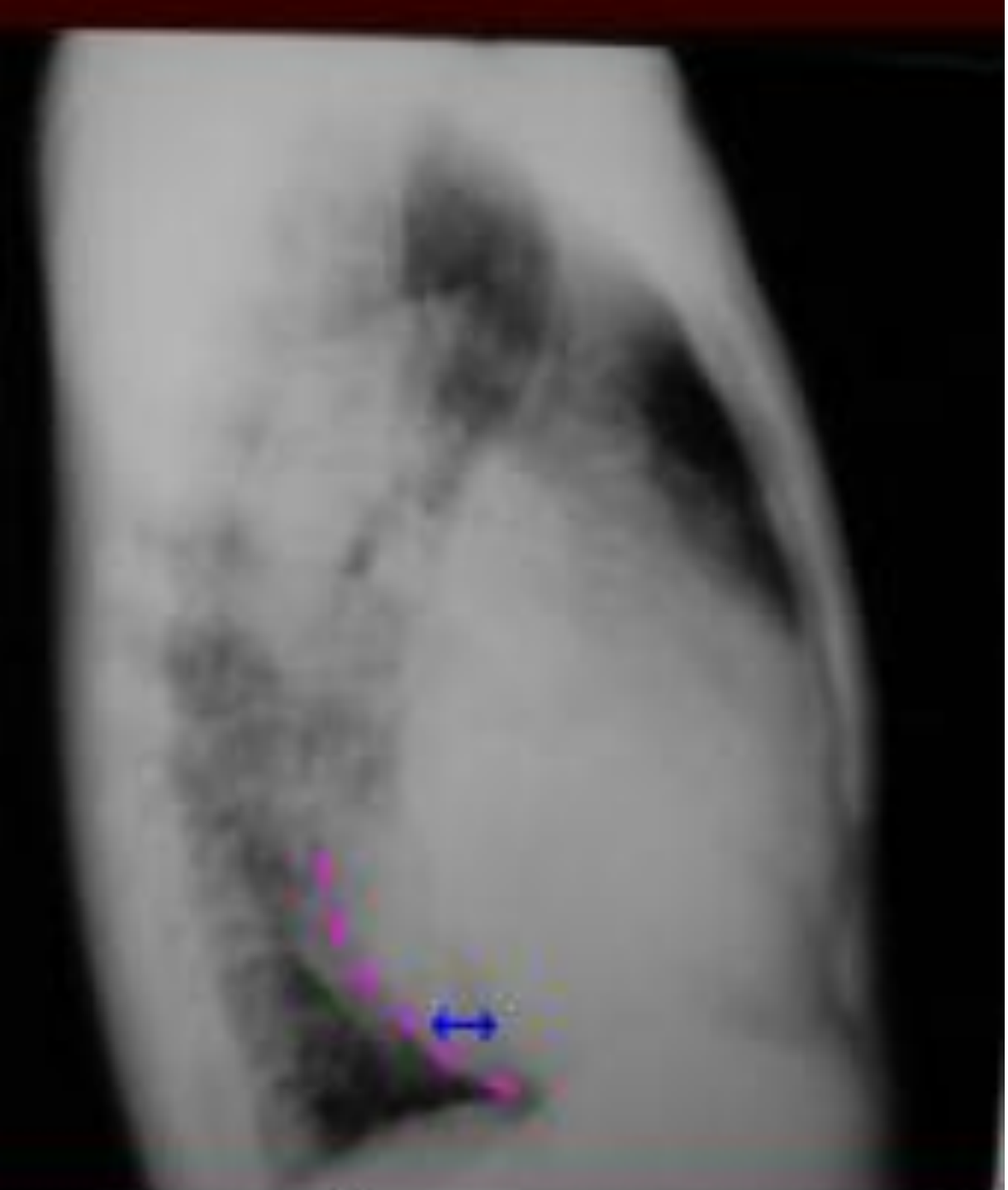
It causes rounded and upwards or uplifted apex and straightens the left heart border. Cardiophrenic angle is less than 90^0

Dr. SHAMOL/Radio logy



Left Ventricular Enlargement

- PA View: lateral and downward displacement of the cardiac apex



Left Ventricular Enlargement

- Lateral view:
- posterior displacement of the posterior inferior border of the heart





Right Ventricular Enlargement

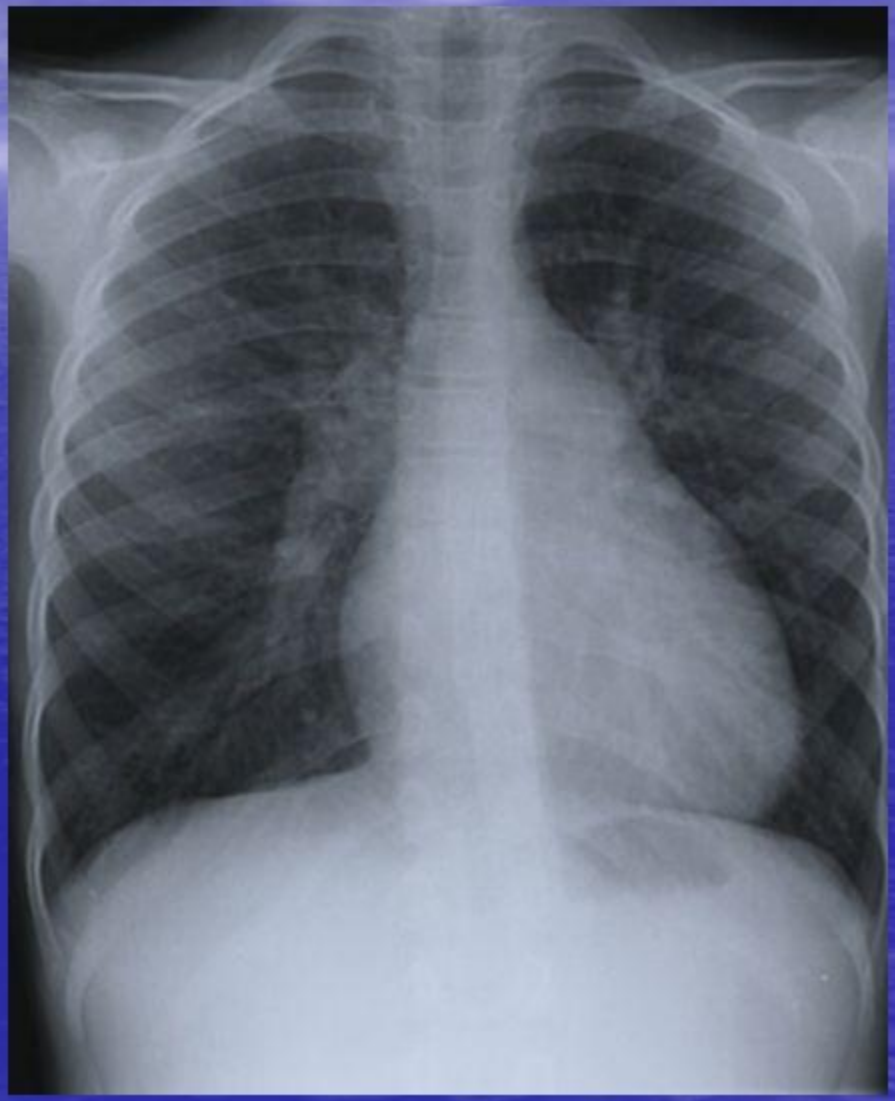
- PA View: Rounding and upliftment of cardiac apex



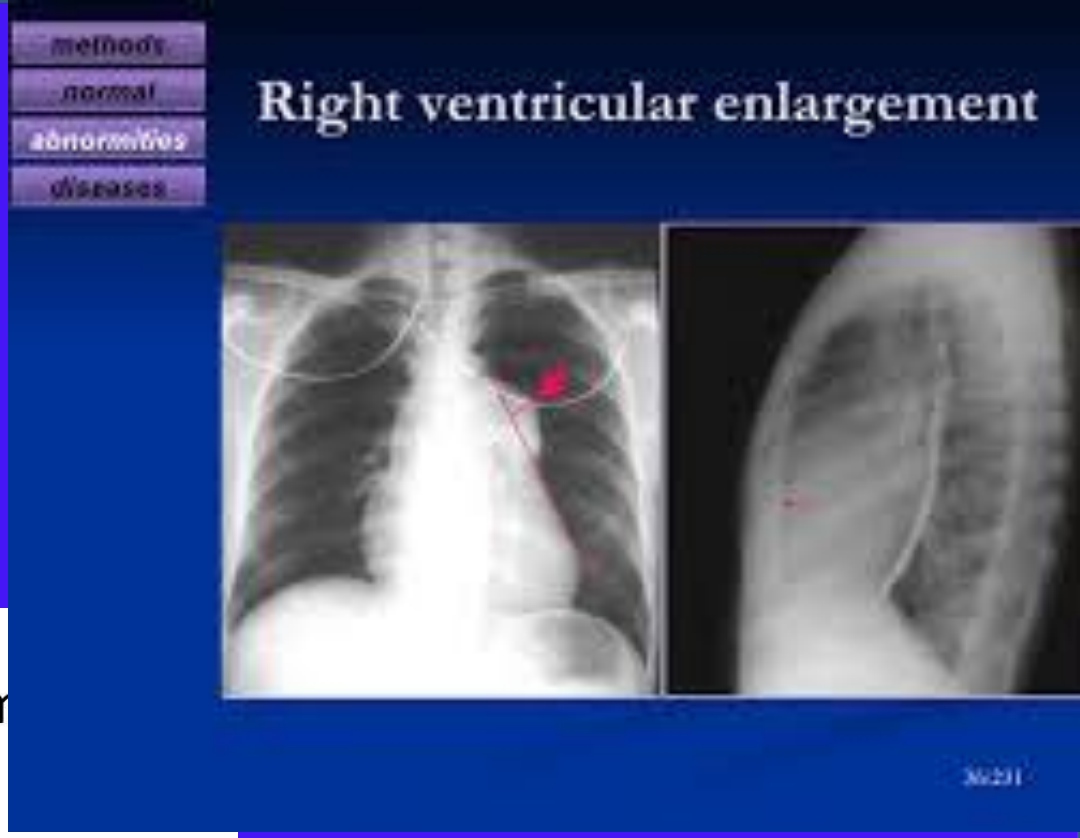
Lateral View:
Retrosternal fullness (contact of anterior cardiac border greater than 1/3 of the sternal length

CXR FINDINGS

- MOD. CARDIOMEGALY
- RA ENLARGEMENT
- RV ENLARGEMENT
- PROMINENT MAIN PULM ARTERY
- PLETHORIC LUNG FIELDS







Right Ventricular enlargem

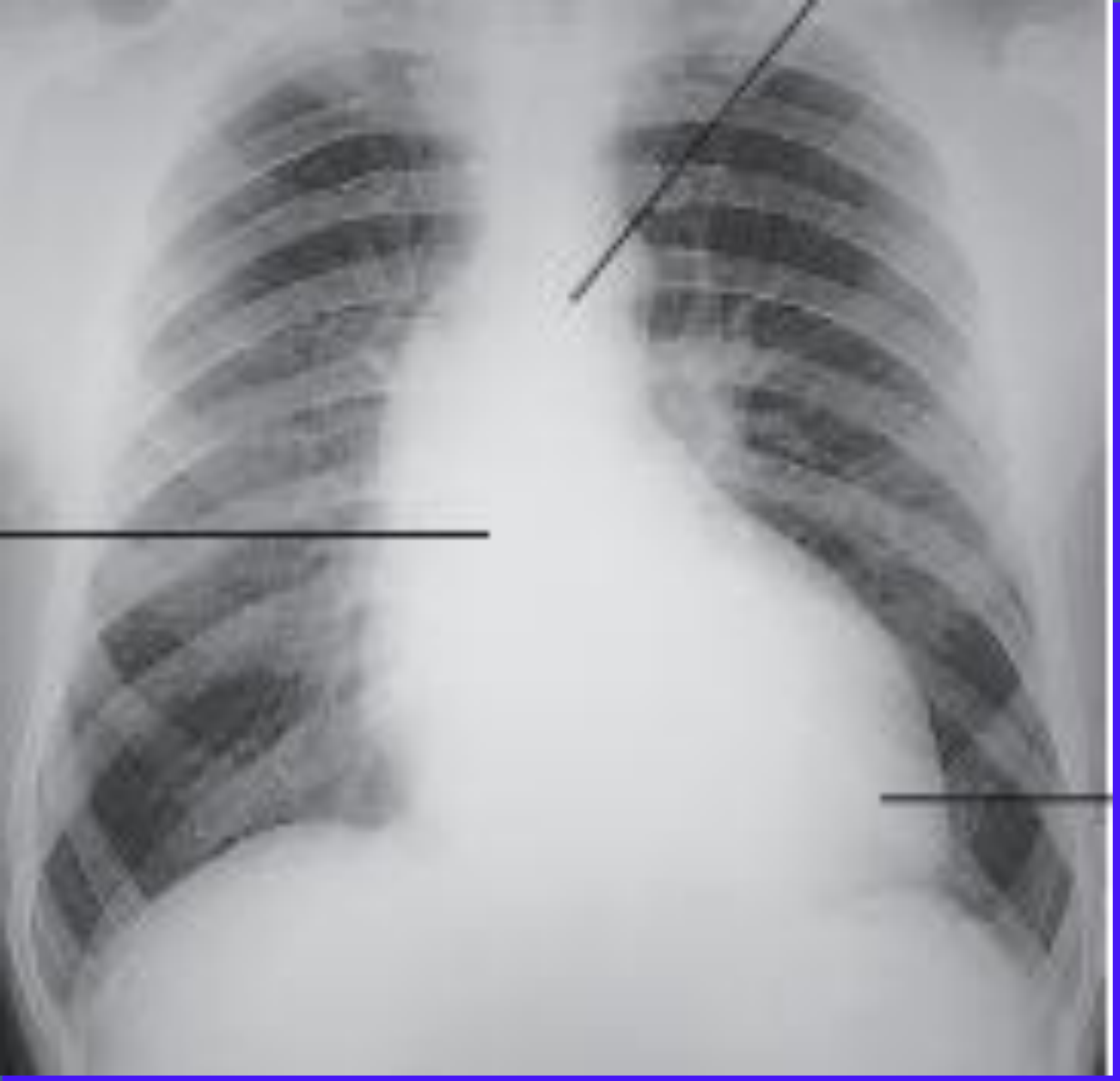
PA CXR:

- Upturned cadiac apex

Lateral CXR:

- > 1/3 contact distance from cadiophrenic sulcus to sternal angle

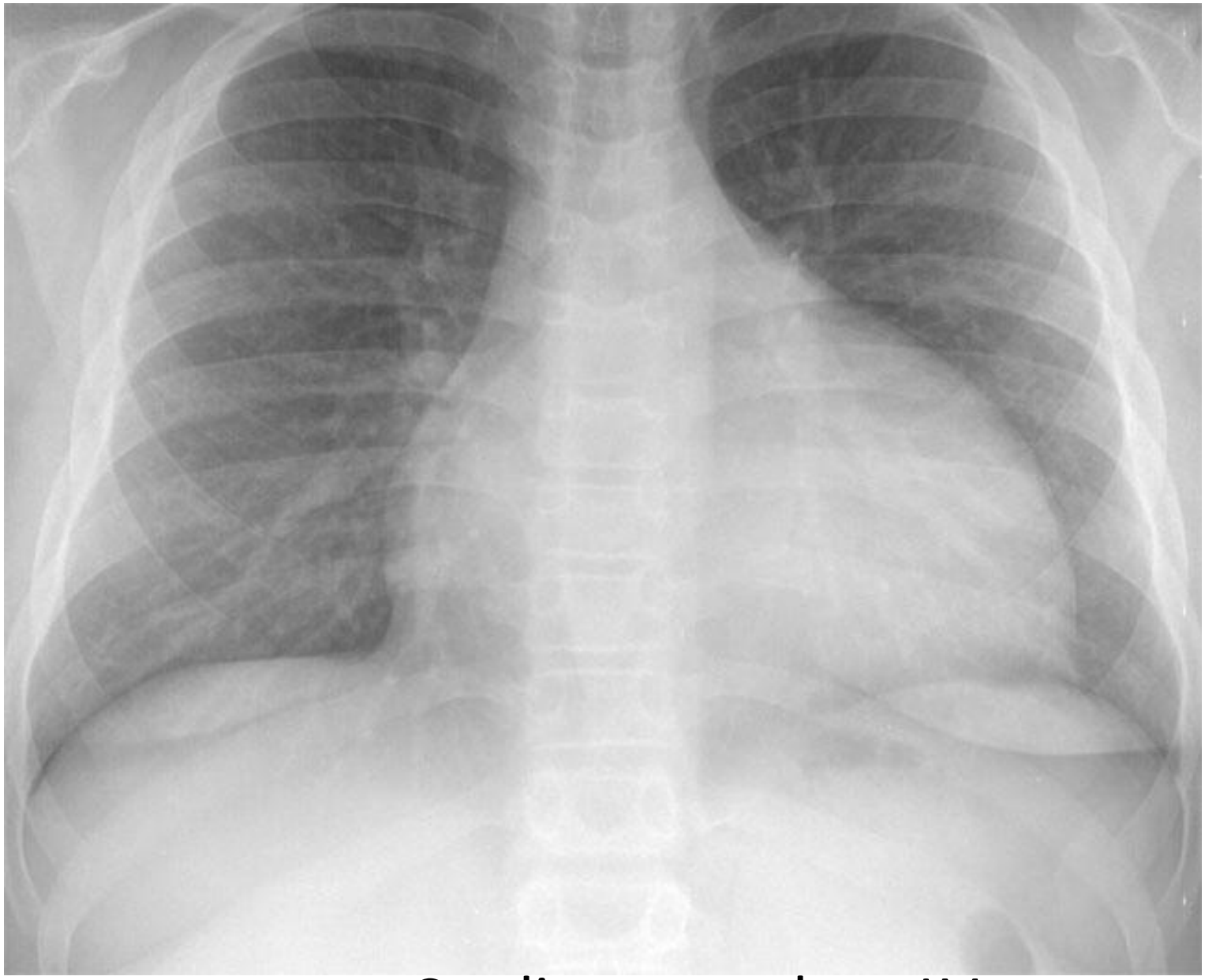
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Left ventricular enlarge

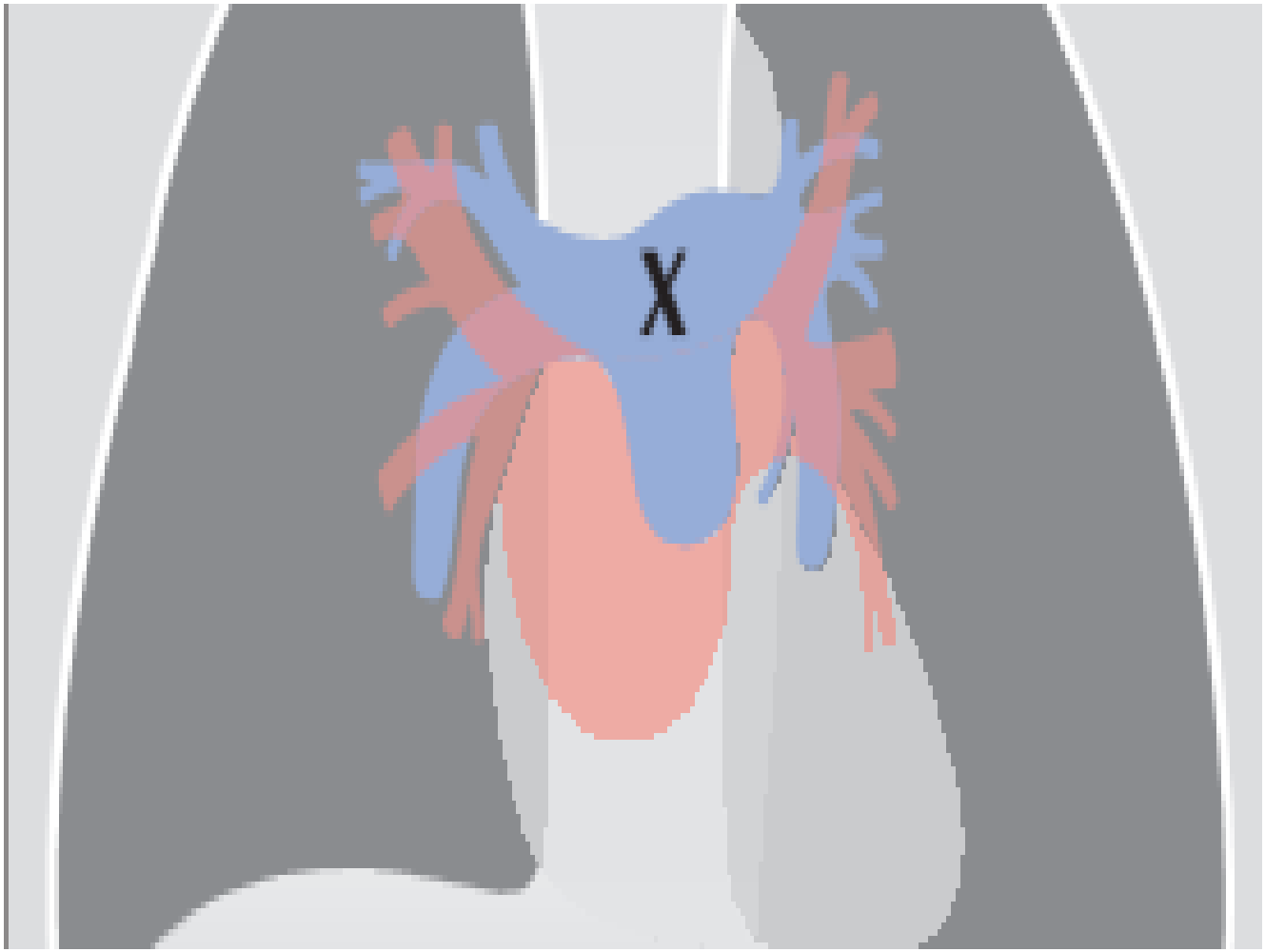
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LV enlargement	Prominent inferior aspect of the left heart border.
RV enlargement	May give a similar appearance to left ventricular enlargement…but often the upper part of the left heart border is most prominent and the cardiac apex is elevated.
LA enlargement	Left atrium A bulge of the left heart border just inferior to the main pulmonary trunk. This bulge is the left atrial appendage.
	Double shadow seen through the heart. This represents the enlarged atrium emerging posteriorly from the cardiac contour and consequently its left and right margins have become outlined by the air in the lungs.
	Gross enlargement can displace and separate the left and right main bronchi so that the carinal angle widens and exceeds 100°. The normal angle does not exceed 100°.
RA enlargement	The right heart border becomes prominent.

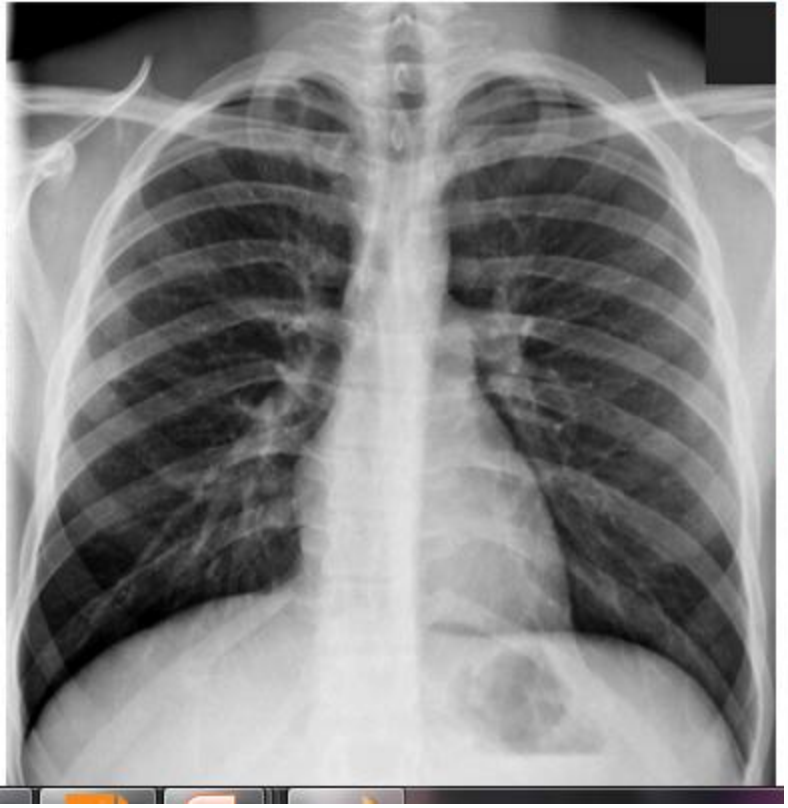


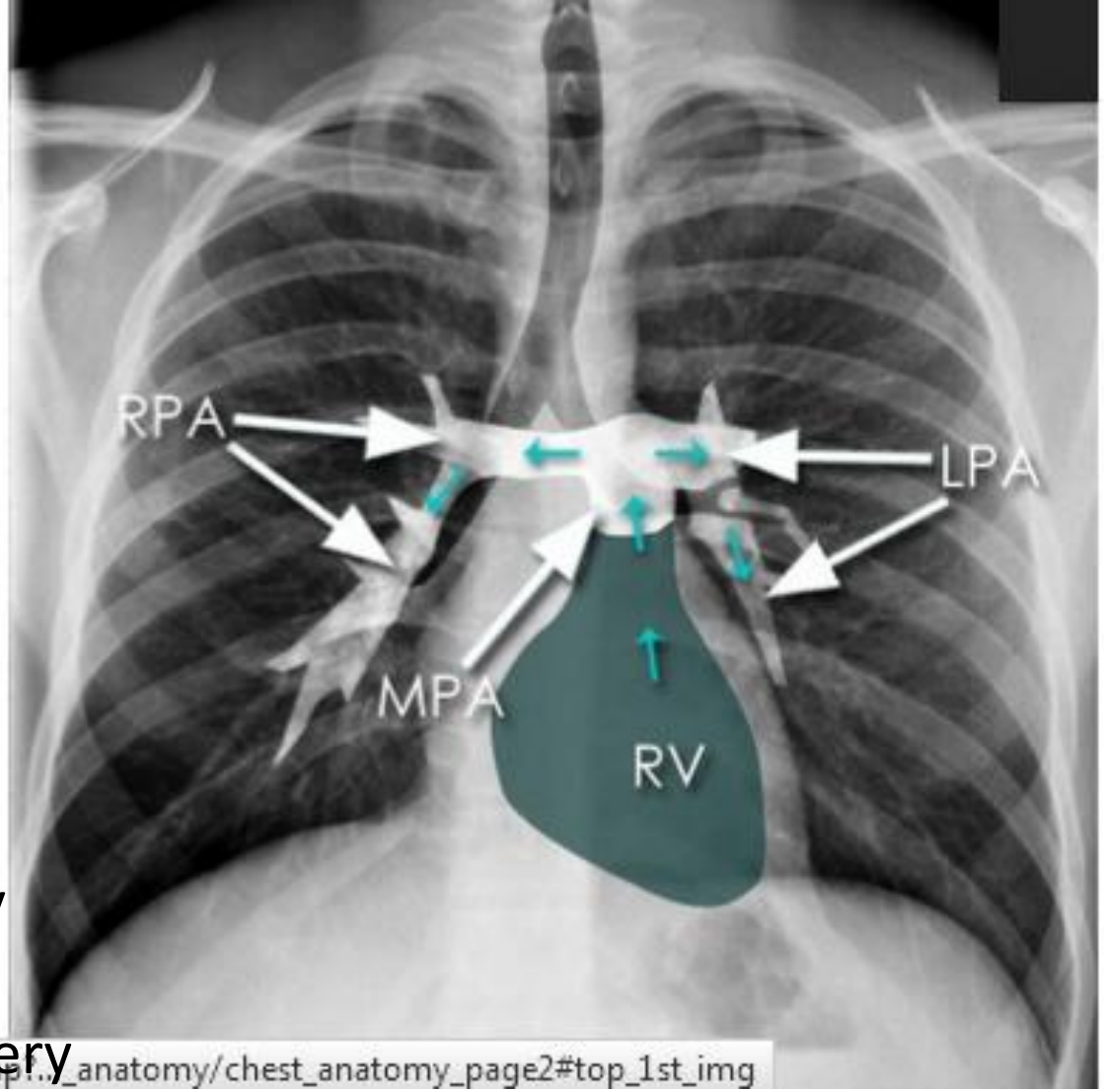
Cardiomyopathy—LV type


HILUM

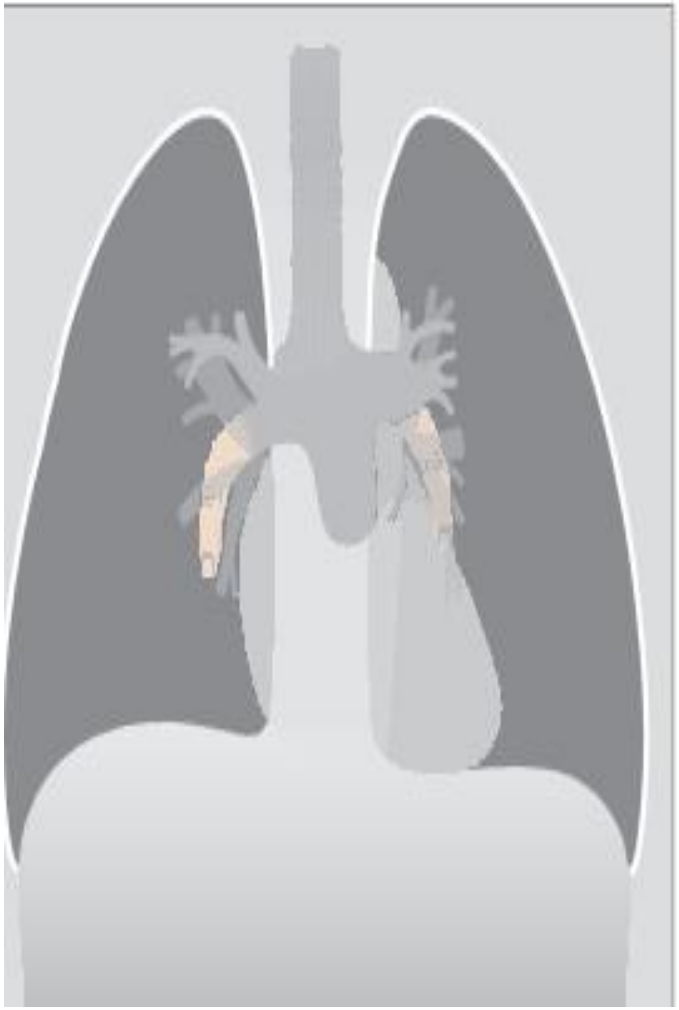


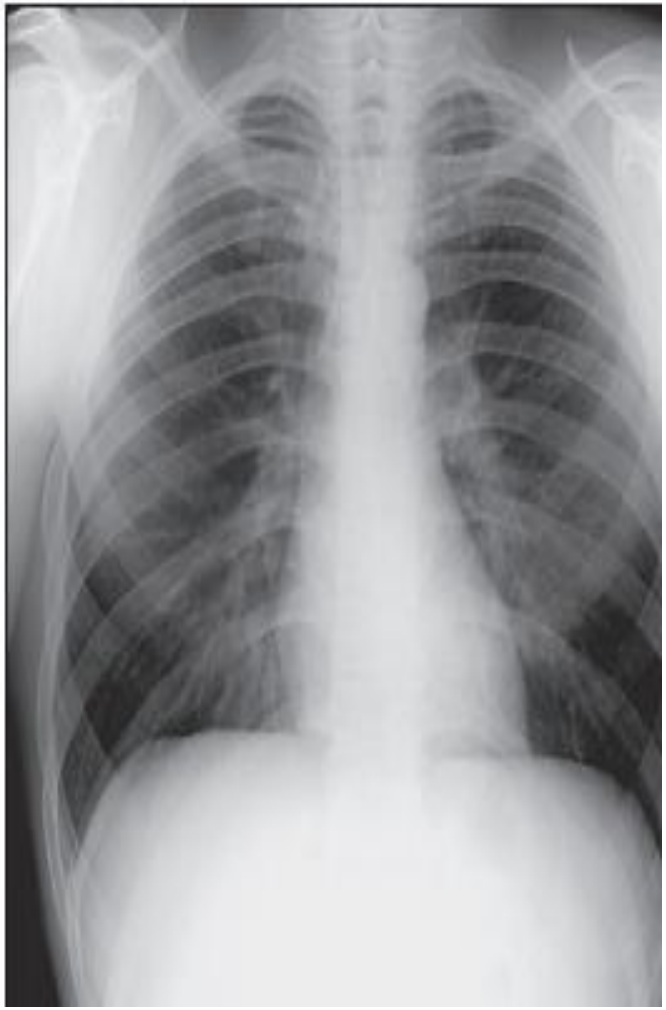
The hilar shadows are due to pulmonary arteries and pulmonary veins. X marks the main pulmonary trunk. Blue = pulmonary trunk and pulmonary arteries; brown = pulmonary veins; pink = part of left atrium...atrial appendage not shown.





RPA-right pulmonary artery
LPA-left pulmonary artery
MPA—main pulmonary artery

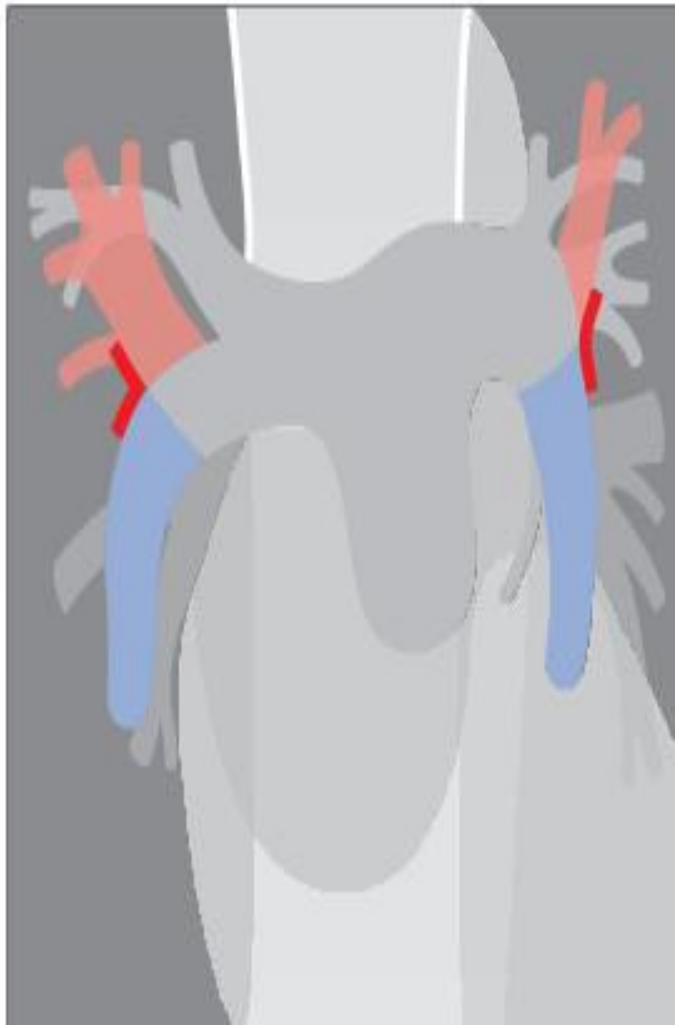




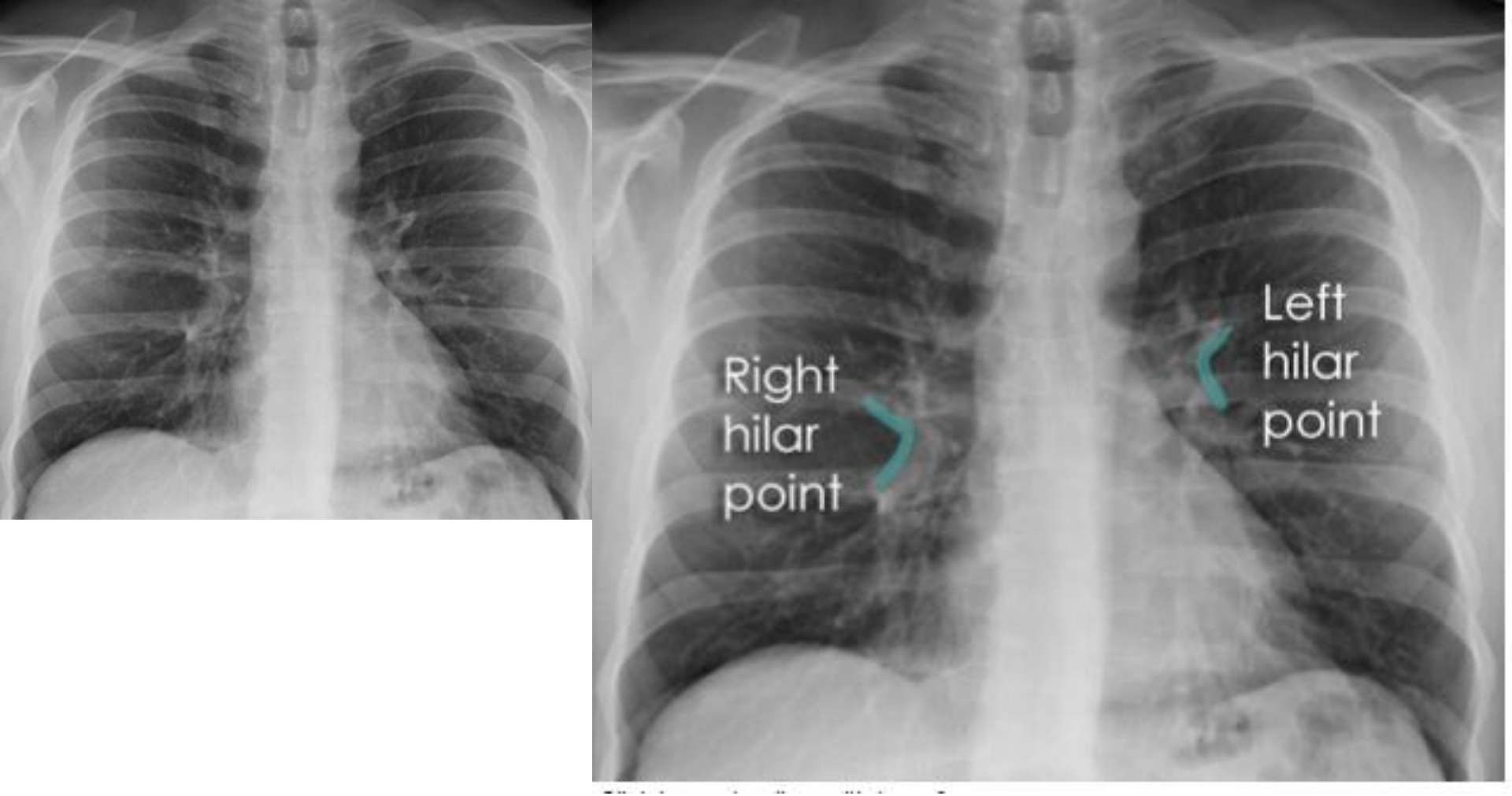
The main lower lobe pulmonary arteries can be likened to a little finger pointing downwards. Sometimes—particularly on the left side—this arterial shadow comprises only the proximal phalanx of the finger. We should see these little fingers (or at least their proximal phalanges) on virtually all normal CXRs.



Normal pulmonary angiogram. Right lung. Showing the large, finger-like, descending lower lobe pulmonary artery.



Normal pulmonary angiogram. Right lung. Showing the large, finger-like, descending lower lobe pulmonary artery.


Right
hilar
point
Left
hilar
point

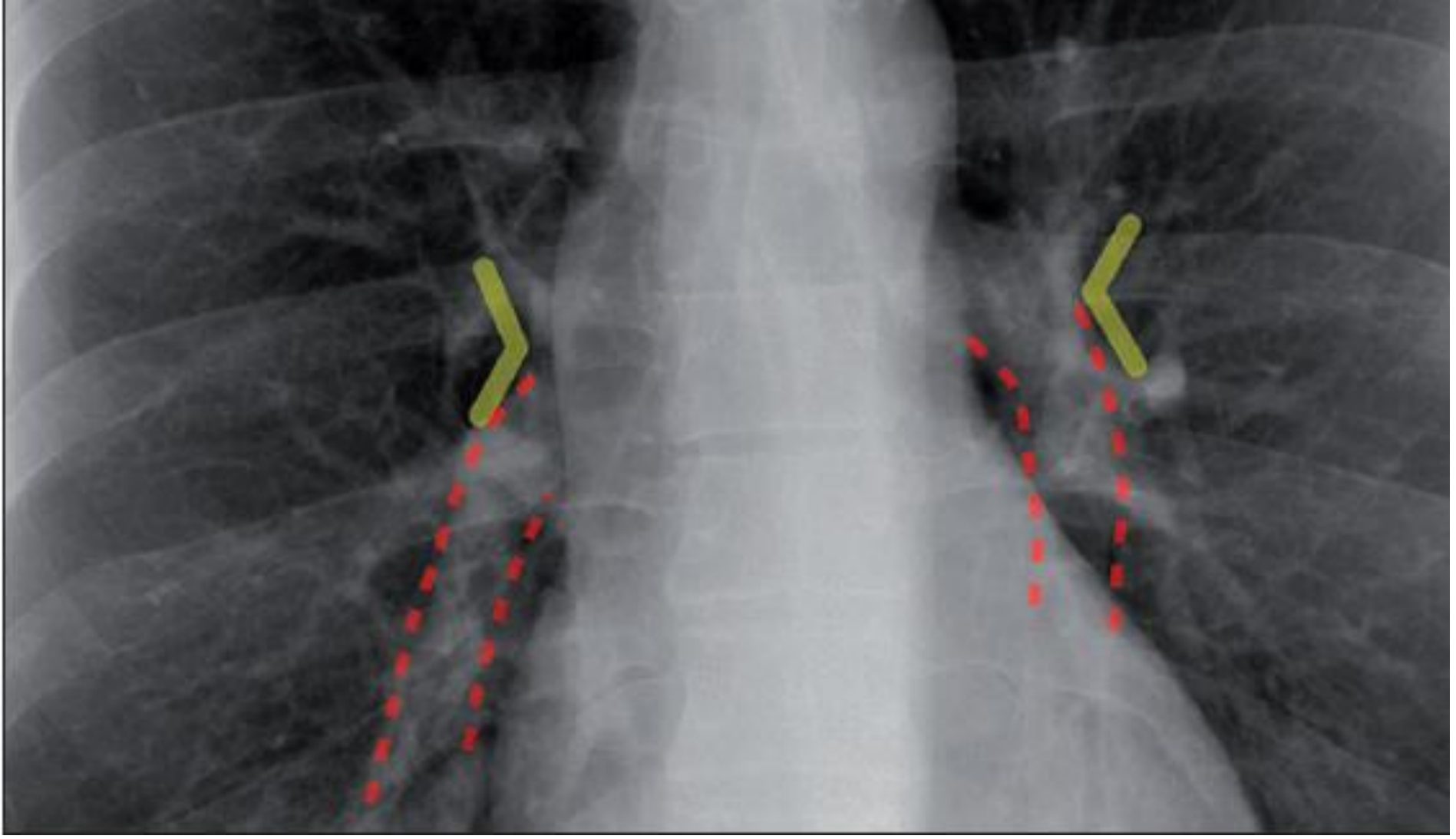
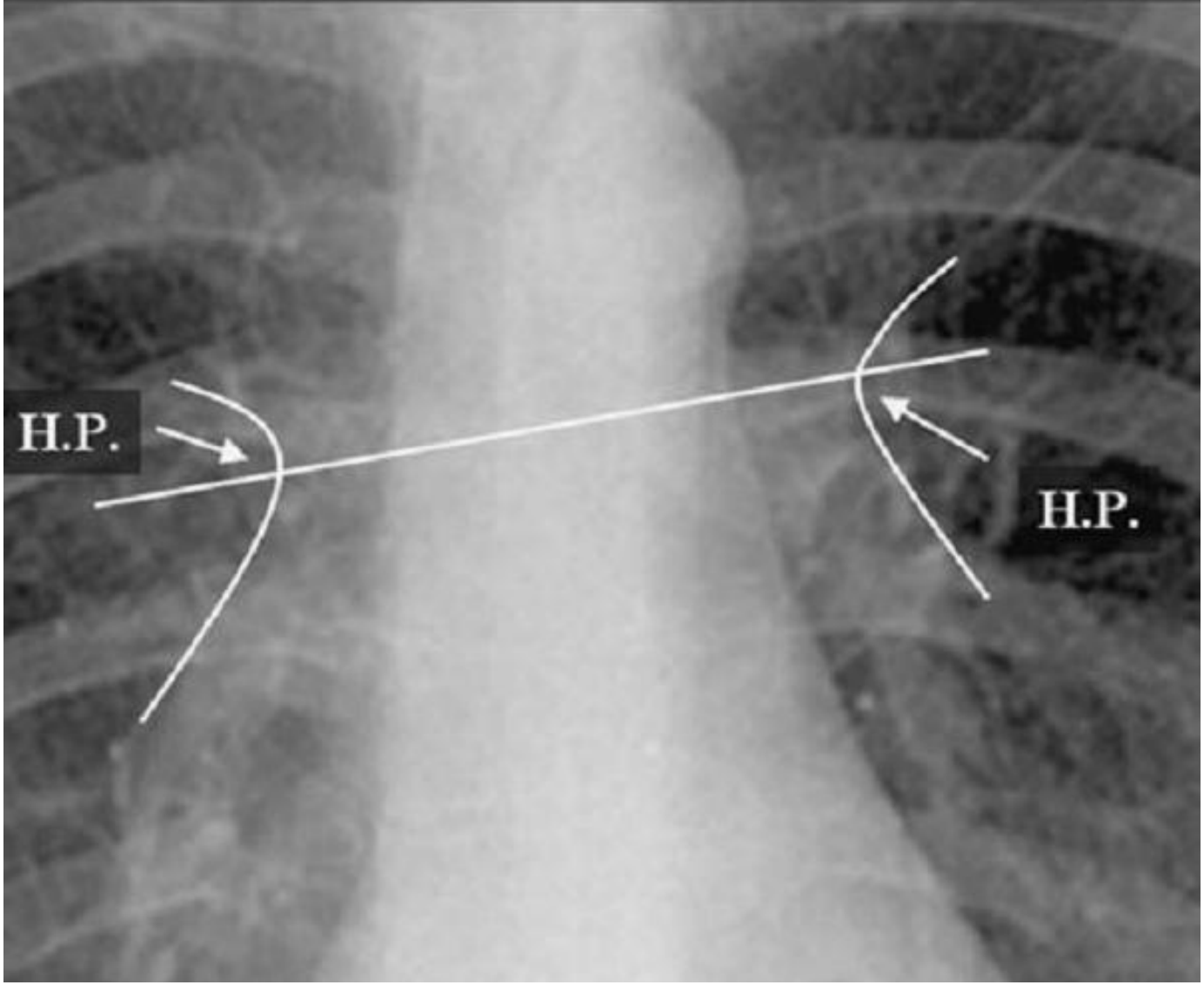


Figure 6.6 *Normal horizontal vees (green) and descending pulmonary arteries (red).*



Both hilar should be concave.
This results from the superior pulmonaryvein crossing the lower lobe pulmonary artery.
The point of intersection is known as the hilar point (HP).
Both hilar should be of similar density.
The left hilum is usually superior to the right by up to 1 cm


a



rst — make sure that rotation is not causing one hilum to appear more conspicuous than the other. This is a very common explanation for a seemingly enlarged hilum. All the same, deciding whether a hilum is abnormal is a common problem. Even the experts have the occasional difÄ culty.

Second — always enquire if a previous CXR is available for comparison. If a previous CXR is not available, then ask yourself three questions. If the hilum is normal then the answer to all three questions will be “yes”.

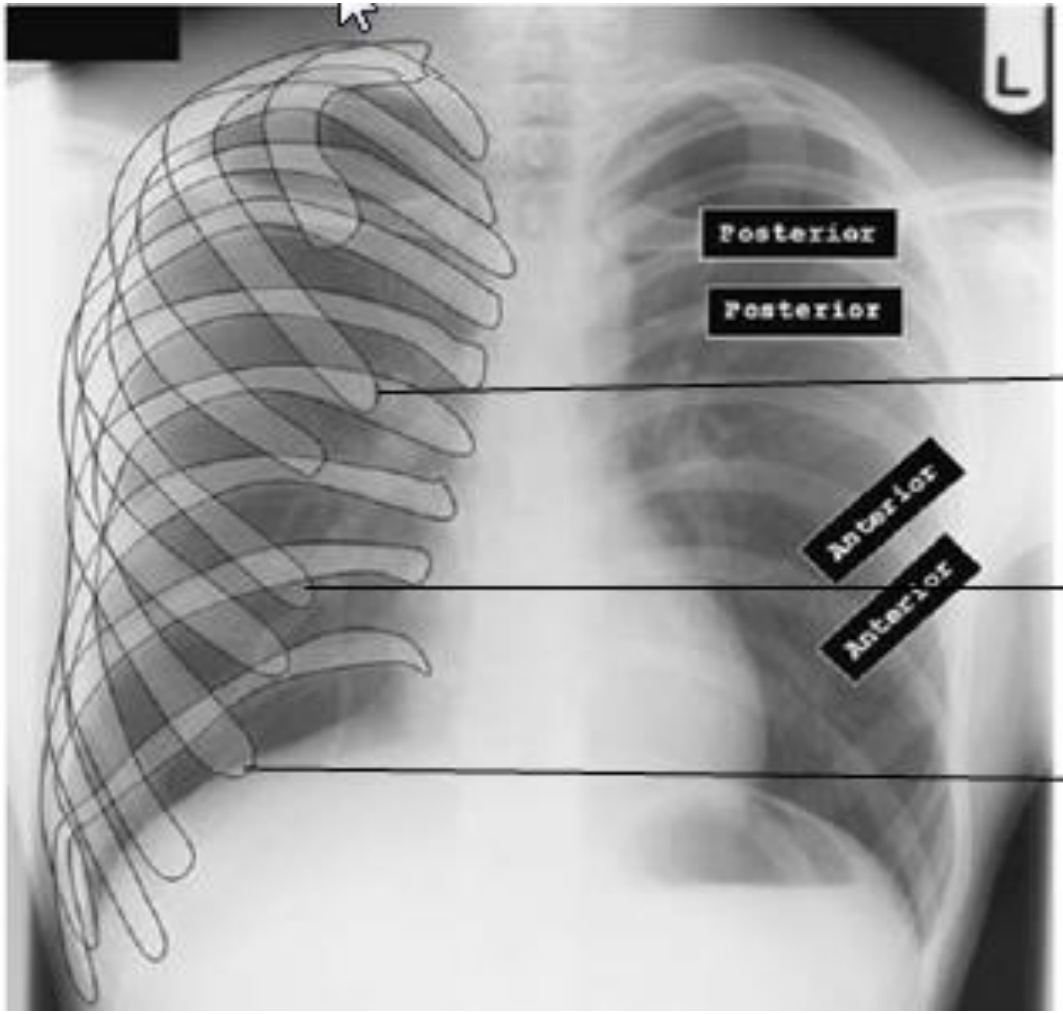
Question 1 Is the left hilum in a normal position? The left hilum must never be lower than the right hilum.

Question 2 Do the branches of the pulmonary artery clearly originate from the site of concern? Normal arteries can be prominent and give an initial impression that enlarged lymph nodes are present.

Question 3 Are the densities of the two hila approximately equal? Anything more than a slight difference in density always raises the suspicion that there is abnormal tissue at the hilum — e.g. a hilar mass.

If the answer to any of these three questions is in the negative, th

Zone of lung
&
Pleura

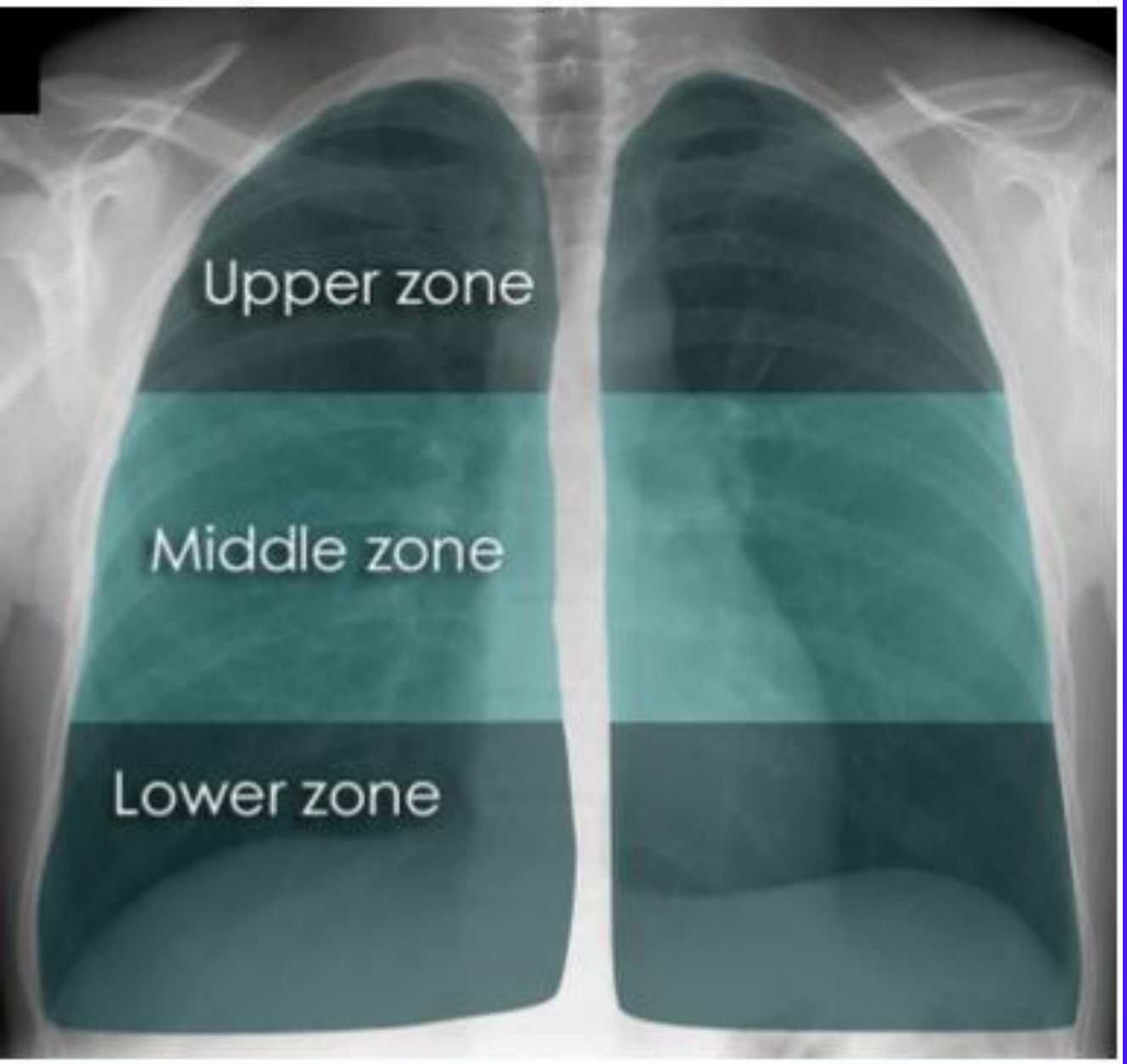


Trace rib from posterior to anterior

Upper zone : up to ant end of 2nd rib

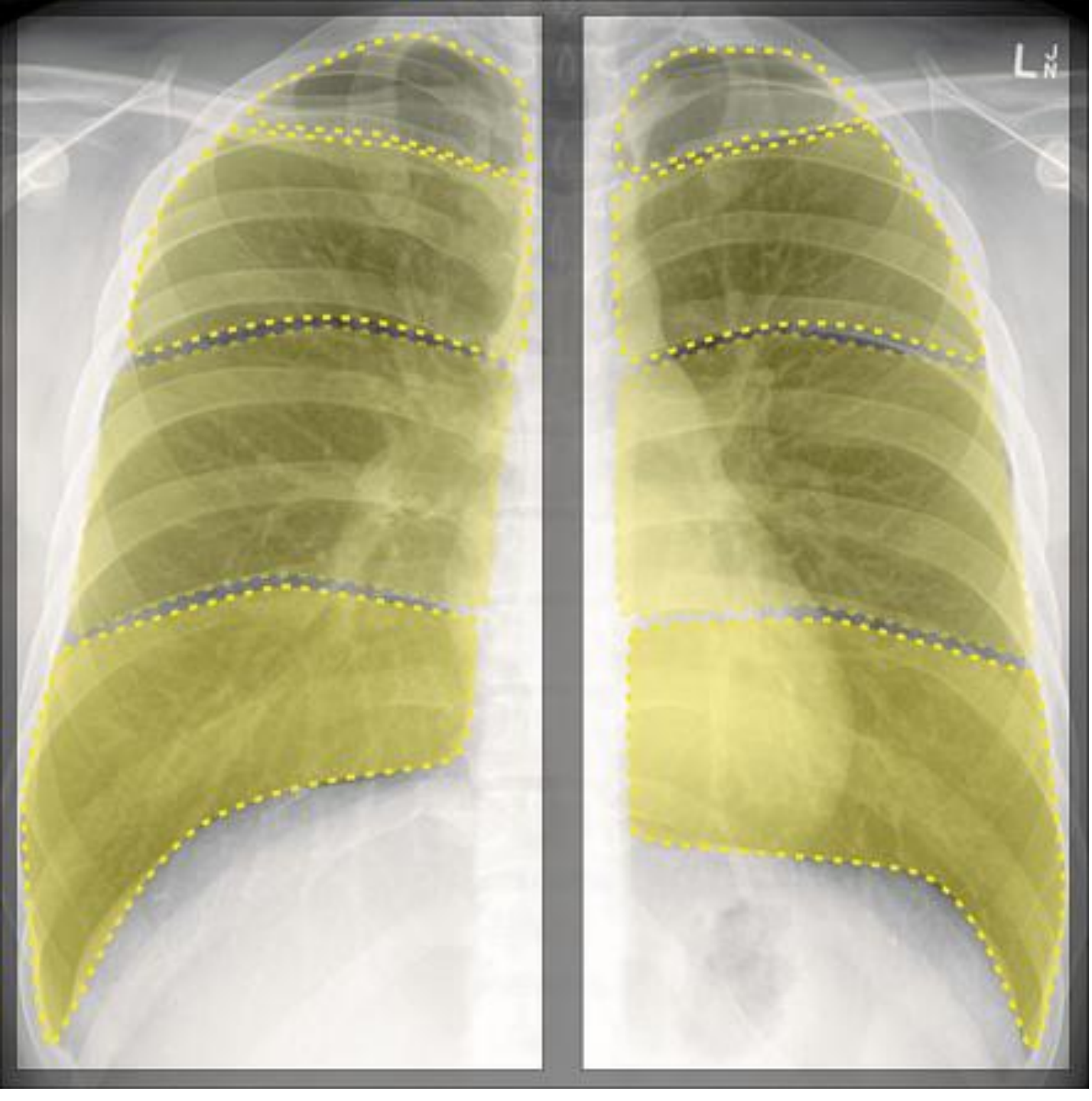
Middle zone: From below upper zone to ant end of 4th rib

Lower zone :
Below middle to and ant end of 6 th



Click image to align with top of page

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Tracing the pluera
Start and end at the hilaIs there pleural thickening?Is there a pneumothorax? The lung markings should be visible to the chest wallIs there an effusion? The costophrenic angles and hemidiaphragms should be well defined

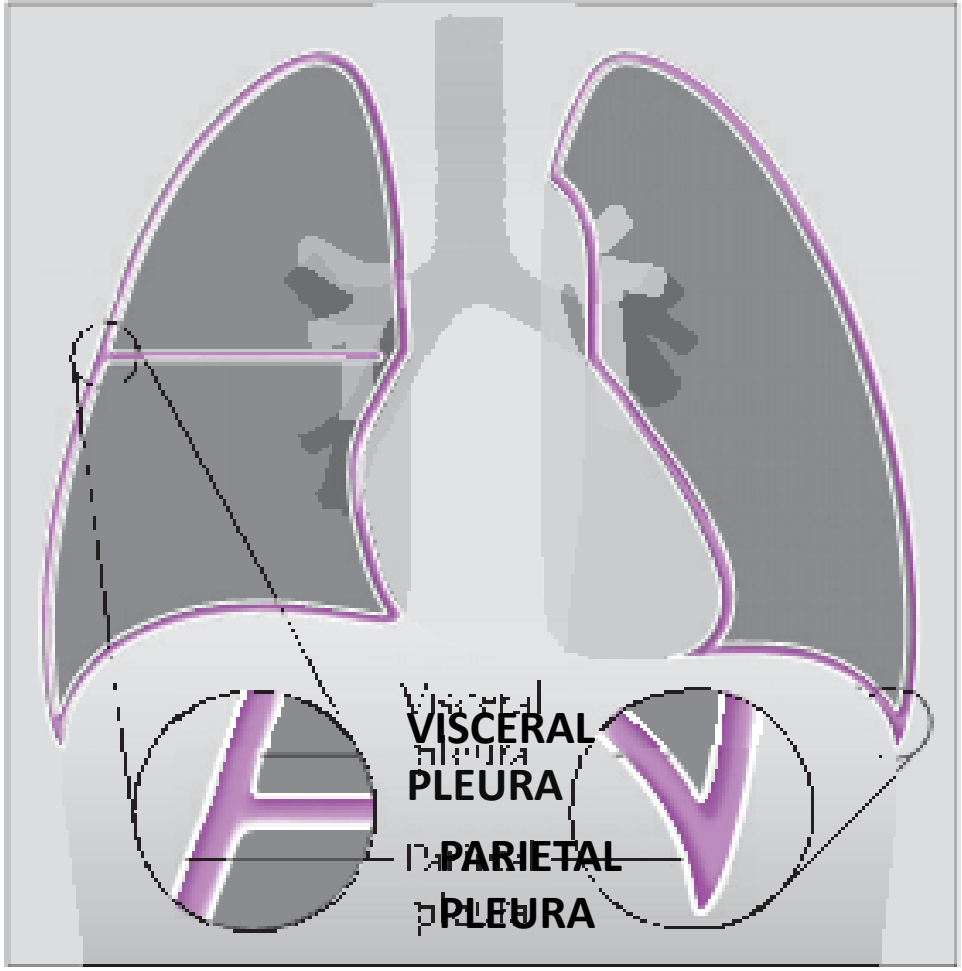


Figure 7.1 *The pleural sac, showing the visceral and parietal pleural membranes. The visceral pleura extends into and lines both sides of the horizontal fissure.*

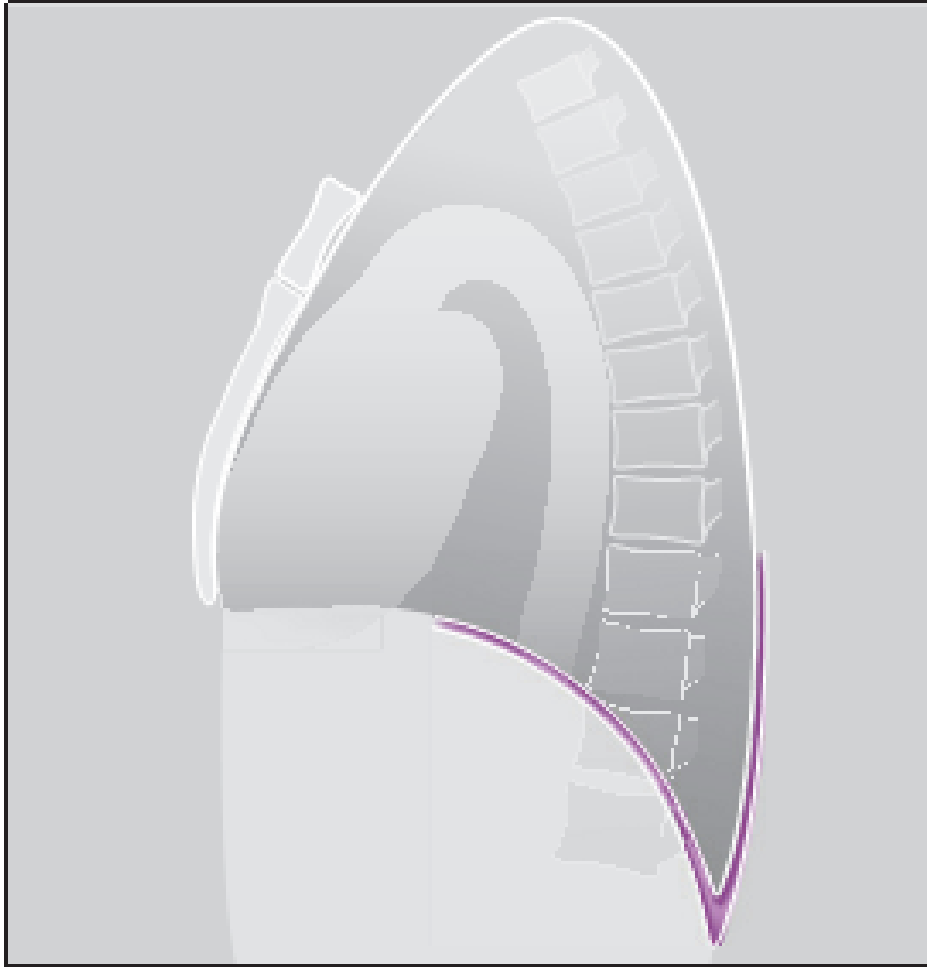
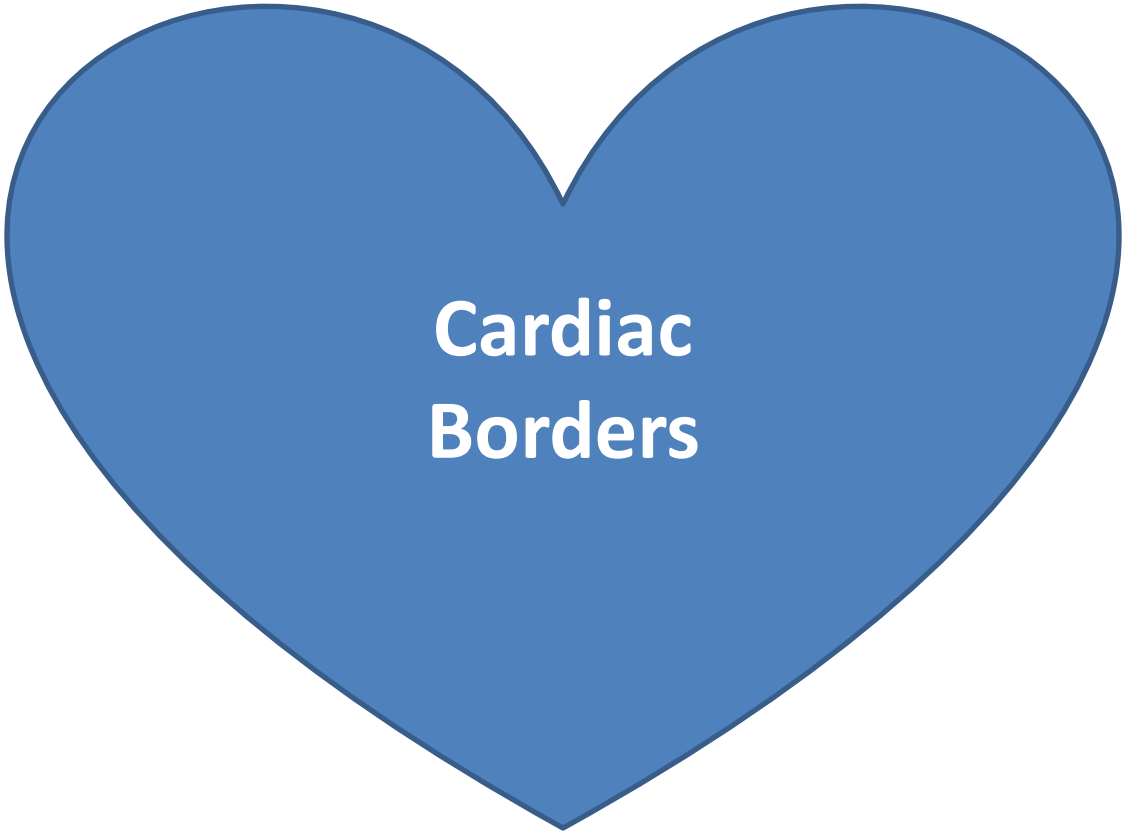
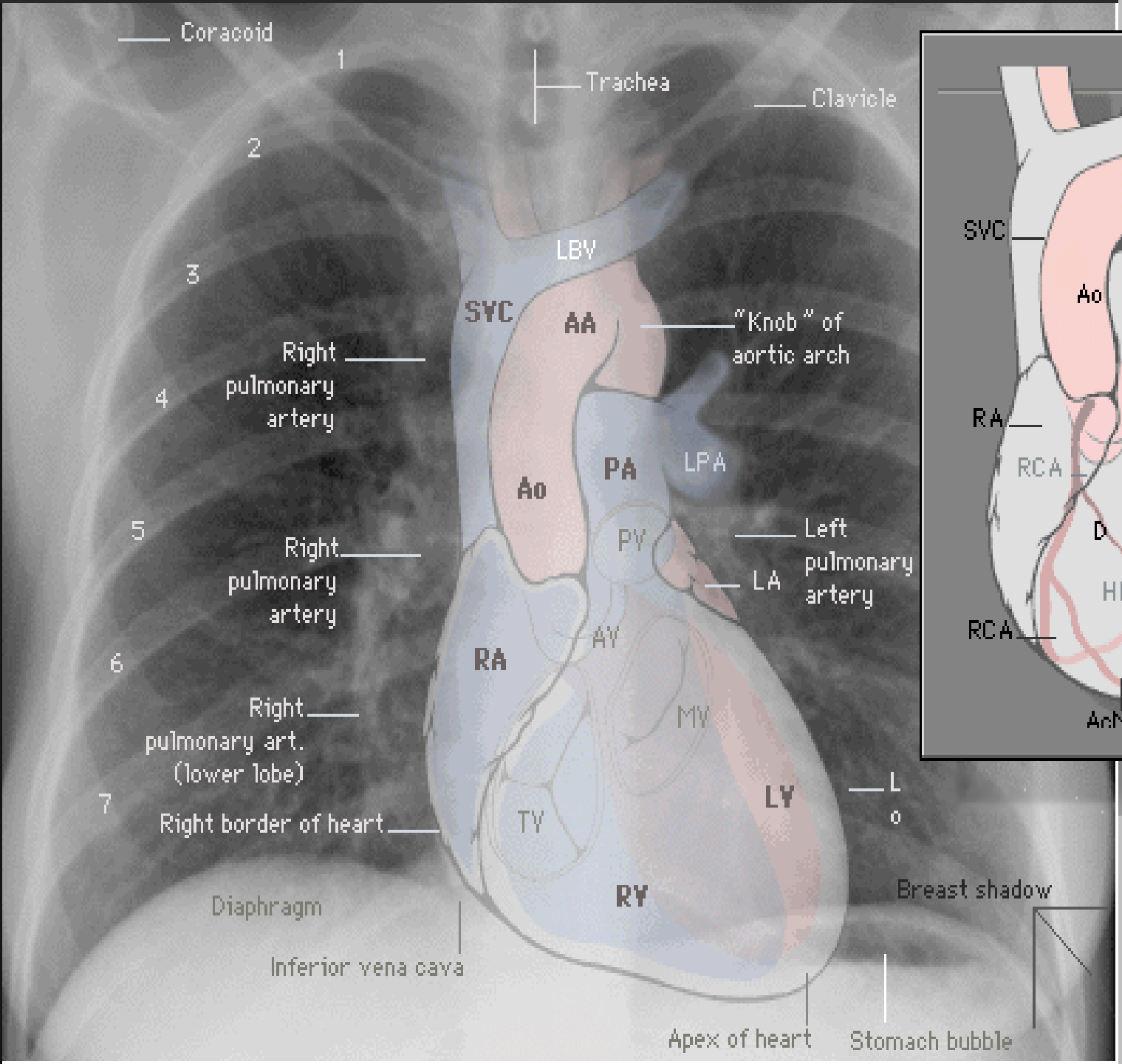
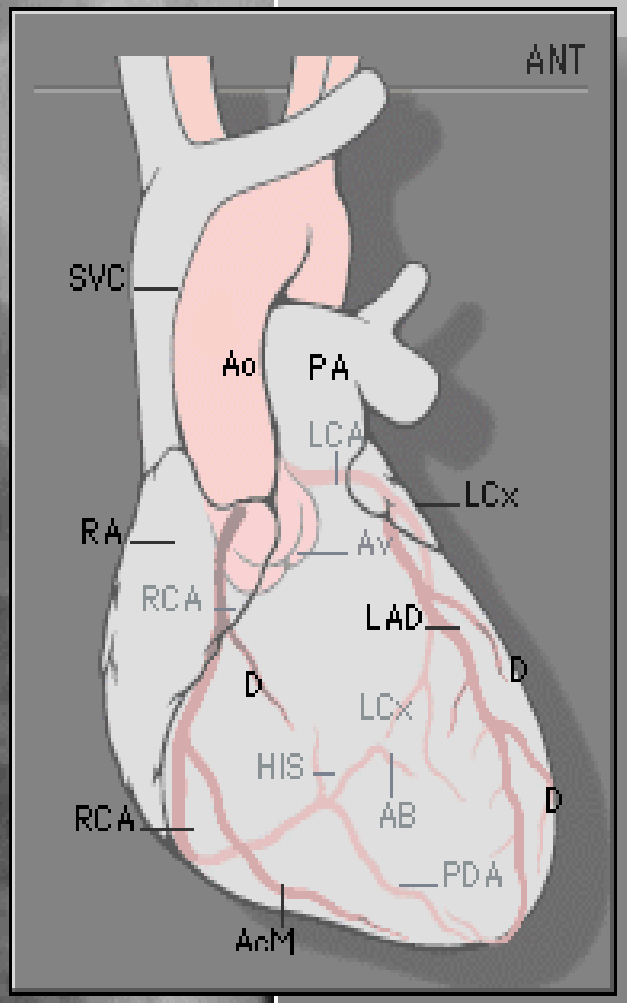
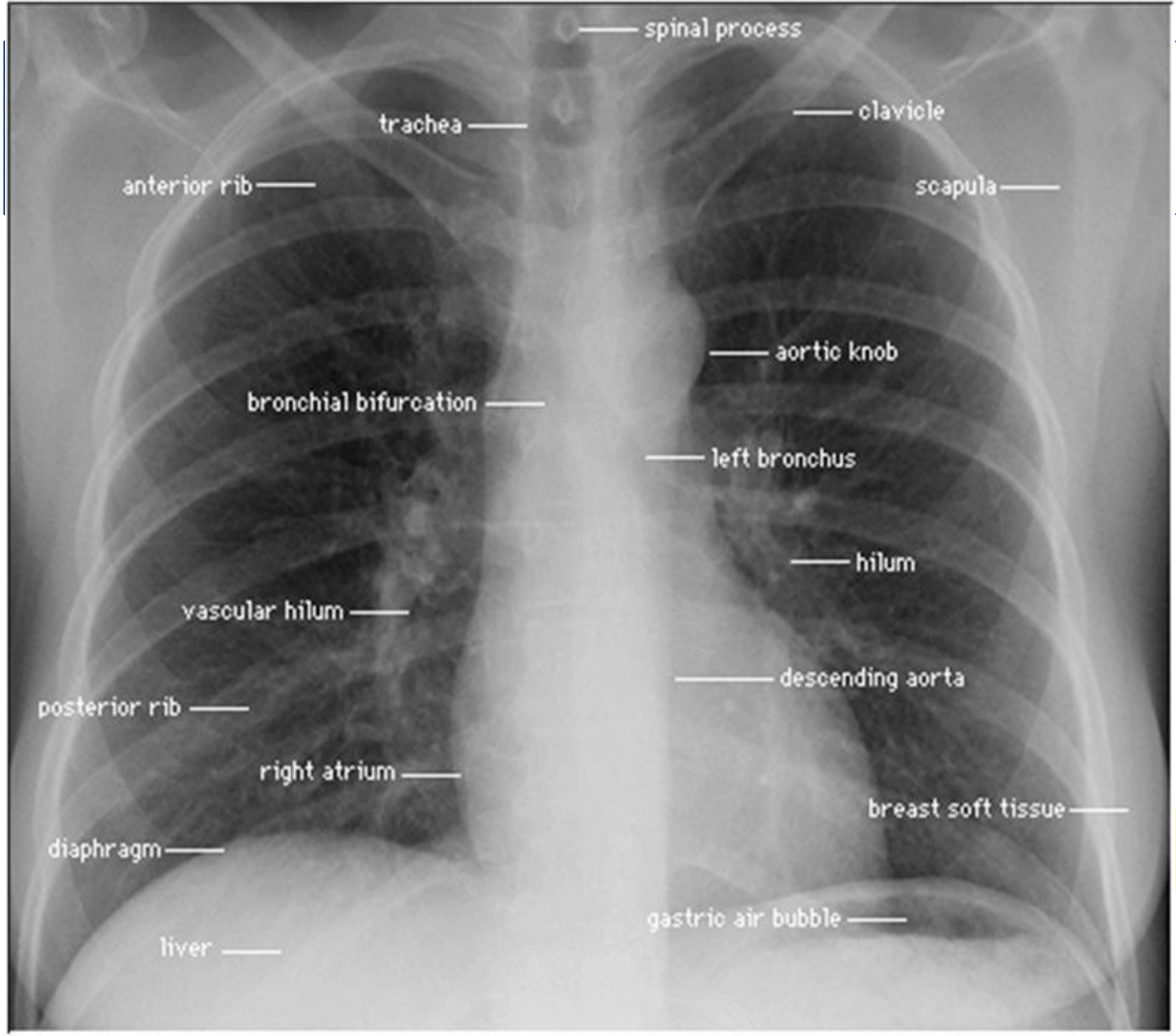


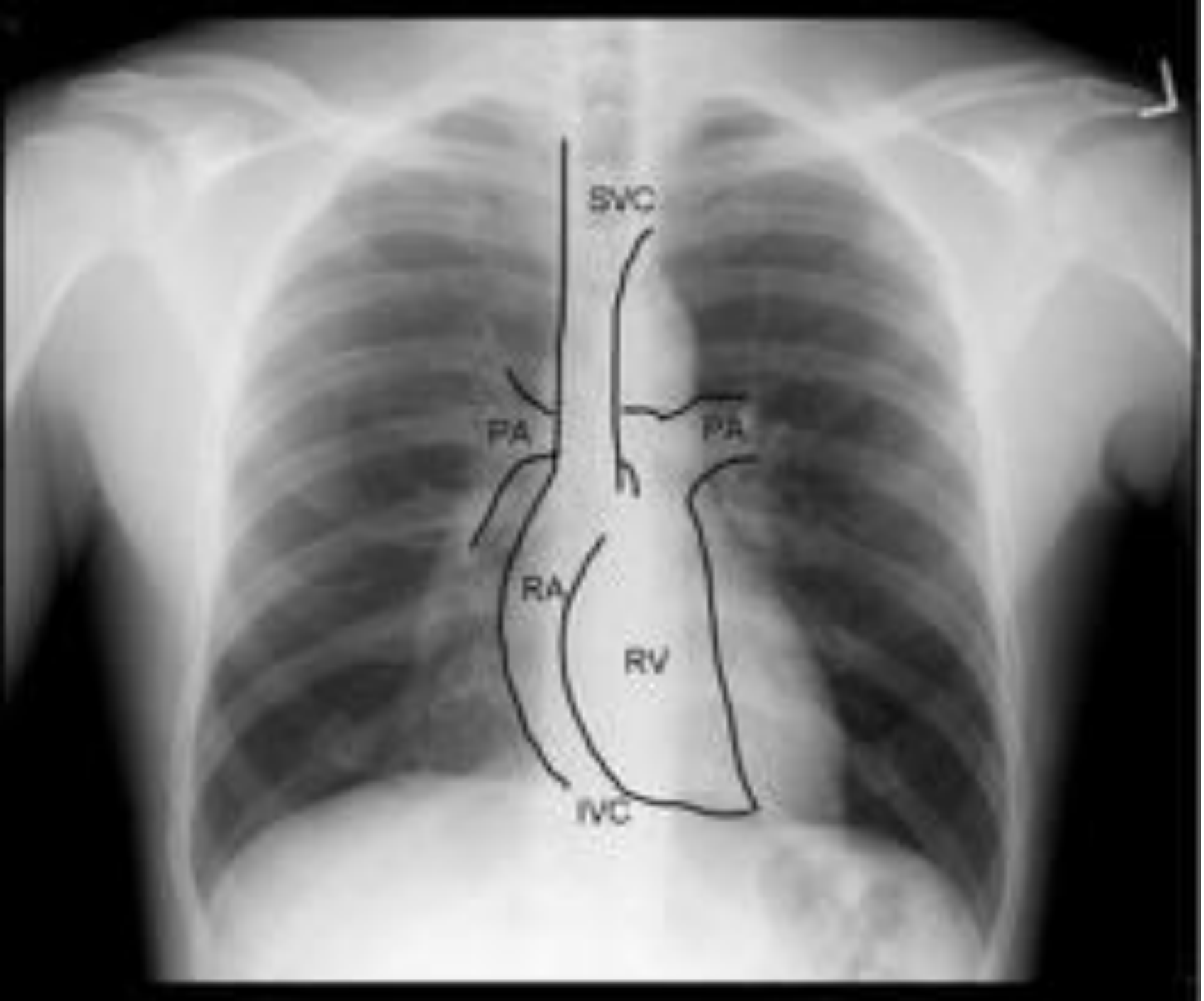
Figure 7.2 *The inferior extent of the posterior pleural space is well shown on the lateral projection. This posterior depth is considerable and not obvious from the frontal CXR.*

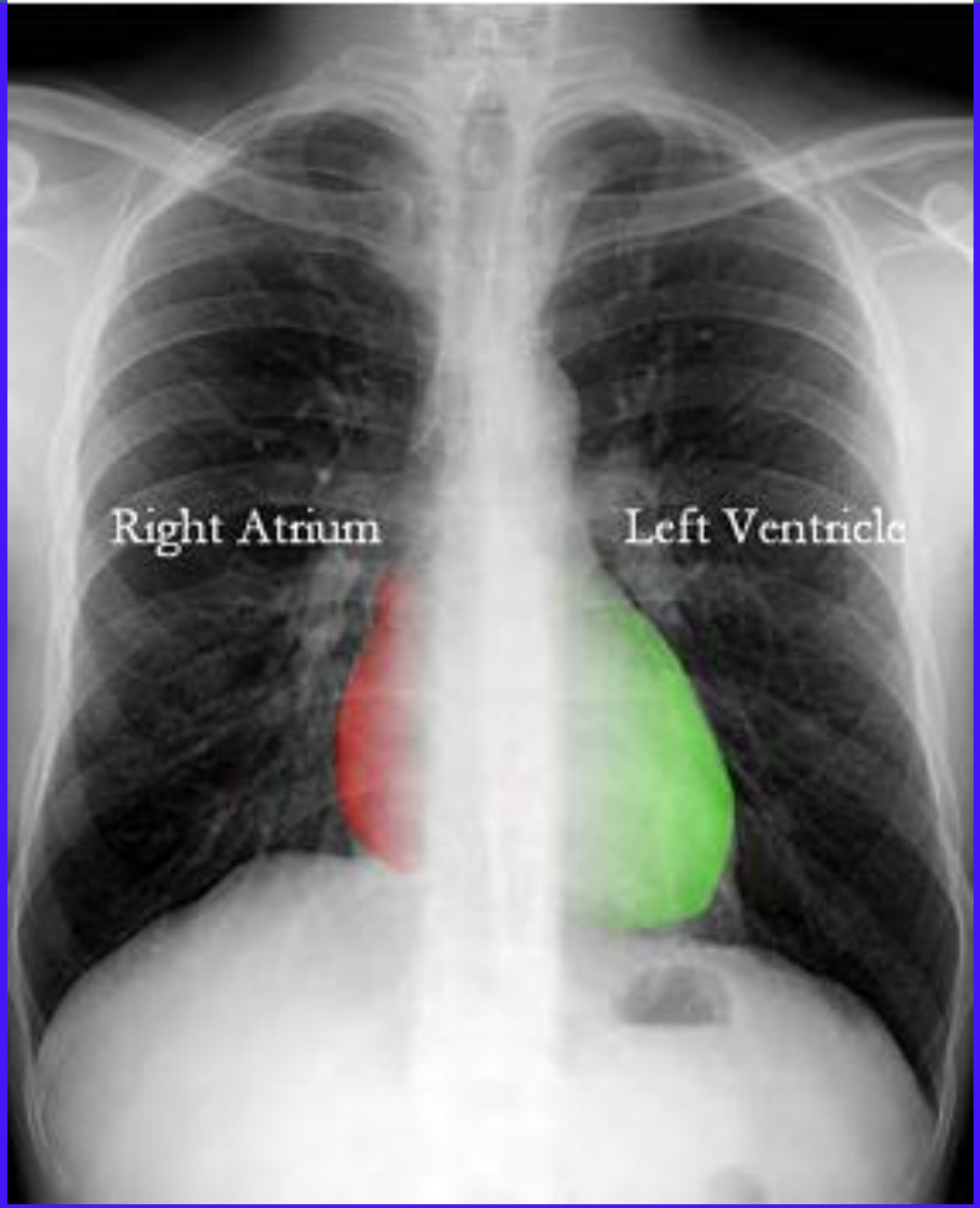

Cardiac
Borders


Coracoid
1
Trachea
Clavicle
2
LBV
3
SVC
AA
"Knob" of aortic arch
Right pulmonary artery
4
Ao
PA
LPA
5
Right pulmonary artery
PV
Left pulmonary artery
LA
AV
RA
6
Right pulmonary art. (lower lobe)
MV
7
Right border of heart
TV
LV
L
o
RV
Diaphragm
Inferior vena cava
Breast shadow
Apex of heart
Stomach bubble

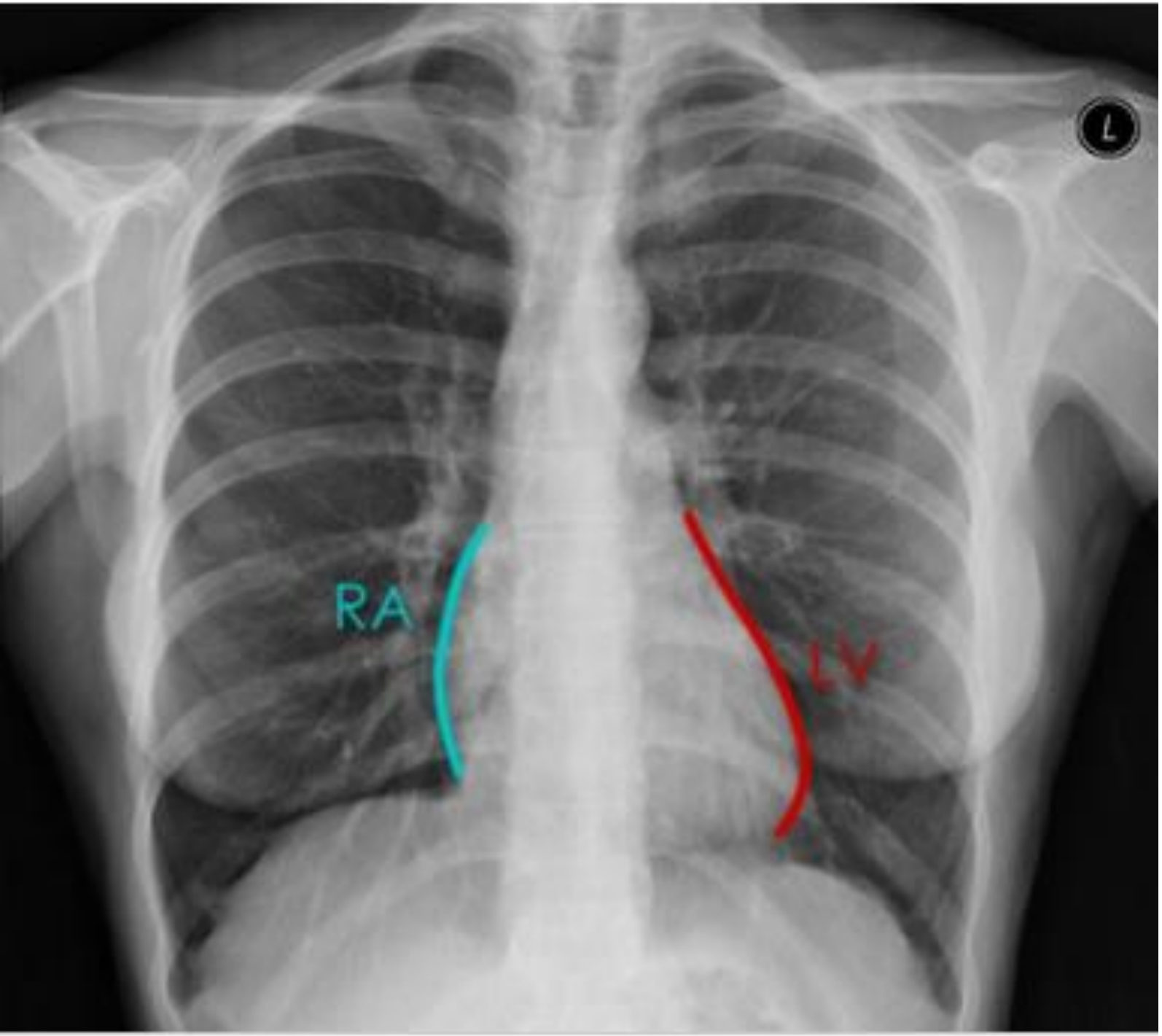

ANT
SVC
Ao
PA
LCA
LCx
RA
AV
RCA
LAD
D
D
LCx
HIS
AB
D
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PDA
ArcM

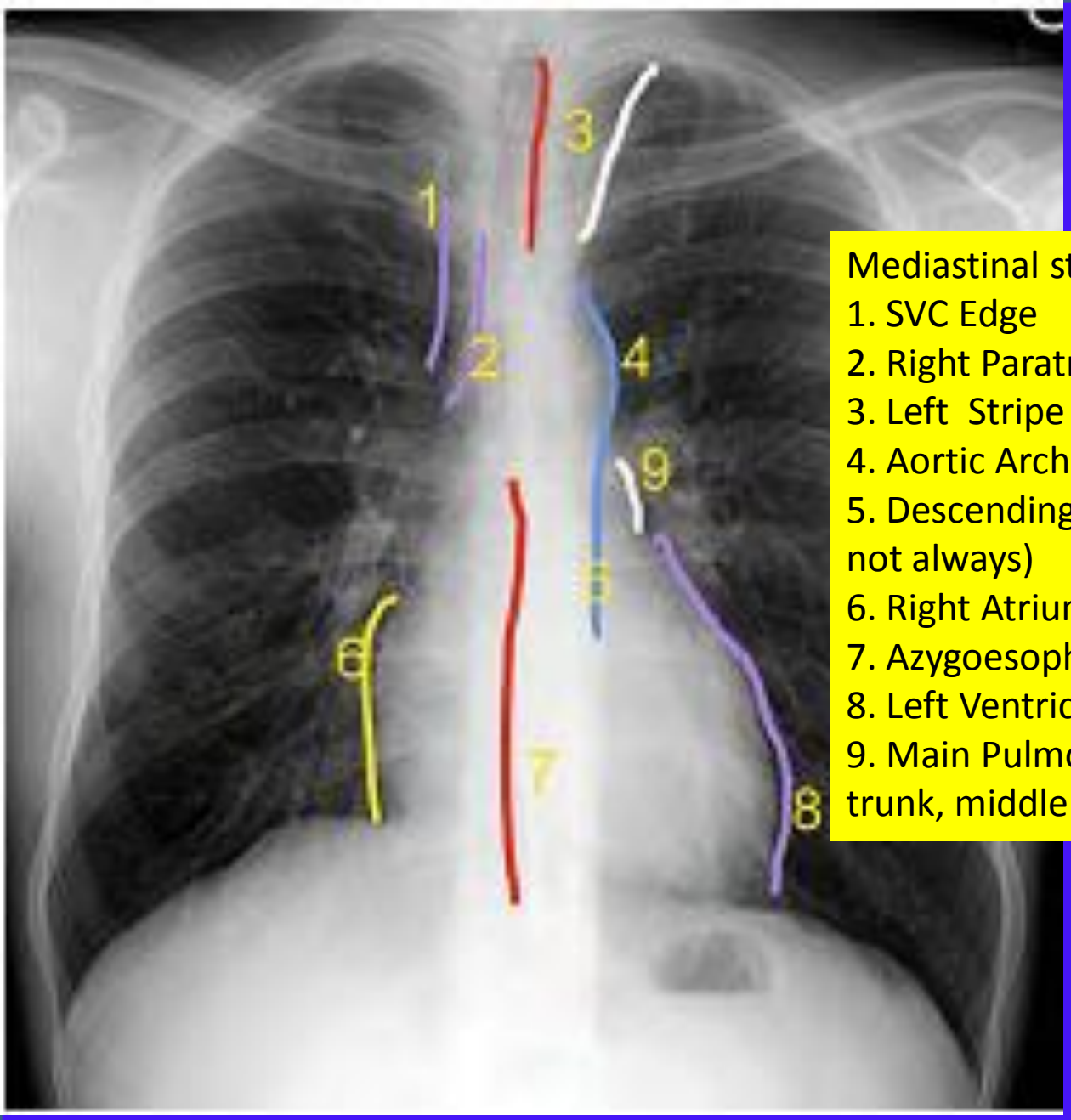

spinal process
trachea
clavicle
anterior rib
scapula
aortic knob
bronchial bifurcation
left bronchus
hilum
vascular hilum
descending aorta
posterior rib
right atrium
breast soft tissue
diaphragm
gastric air bubble
liver


SVC
PA
PA
RA
RV
IVC



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L
RA
LV

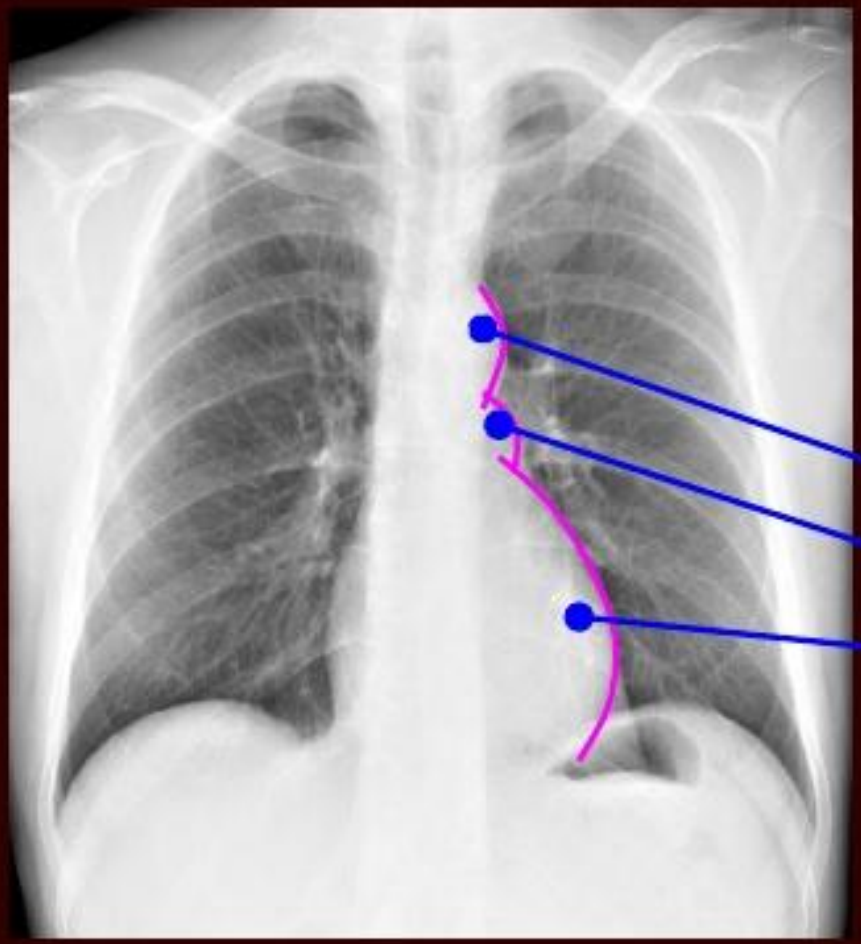


Mediastinal structures on the PA CXR

1. SVC Edge
2. Right Paratracheal Line
3. Left Stripe (both red and white lines)
4. Aortic Arch
5. Descending Aorta (only left edge seen, and not always)
6. Right Atrium
7. Azygoesophageal edge
8. Left Ventricle
9. Main Pulmonary Artery (also known as: trunk, middle mogul)

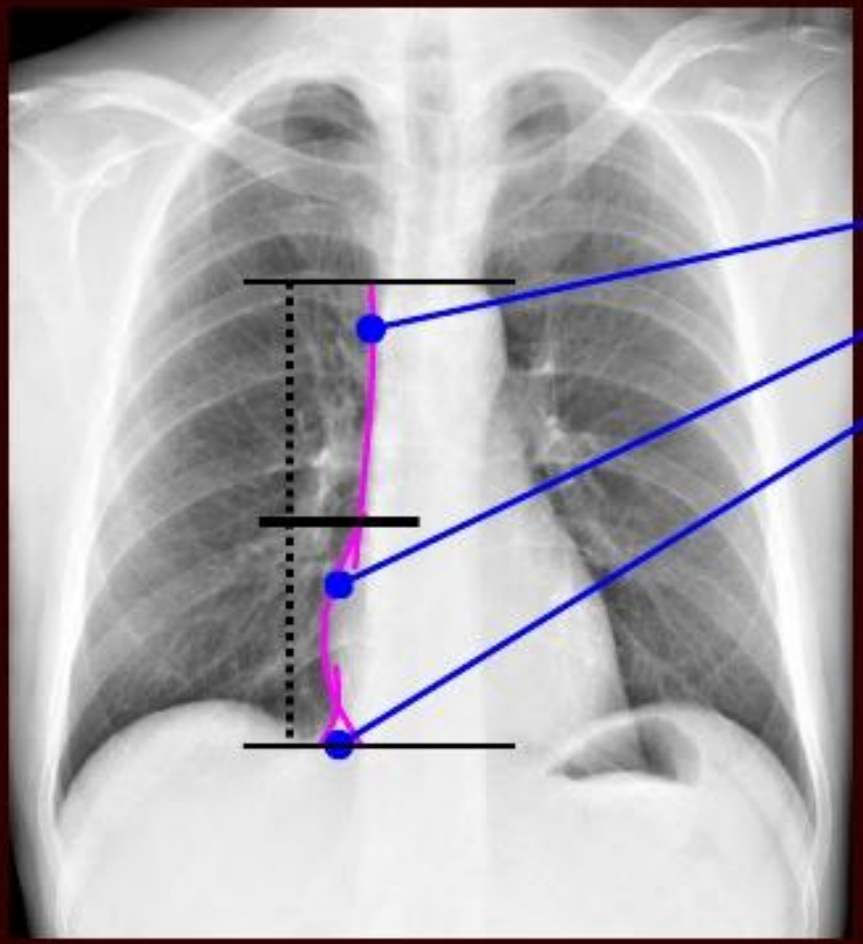
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Postero-Anterior (PA) View



- Right border
  - Superior vena cava
  - Right atrium
  - Inferior vena cava
- Left border
  - Aortic knob
  - Main pulmonary trunk
  - Left ventricle

Postero-Anterior (PA) View



- Right border
  - Superior vena cava
  - Right atrium
  - Inferior vena cava

Features of LVF

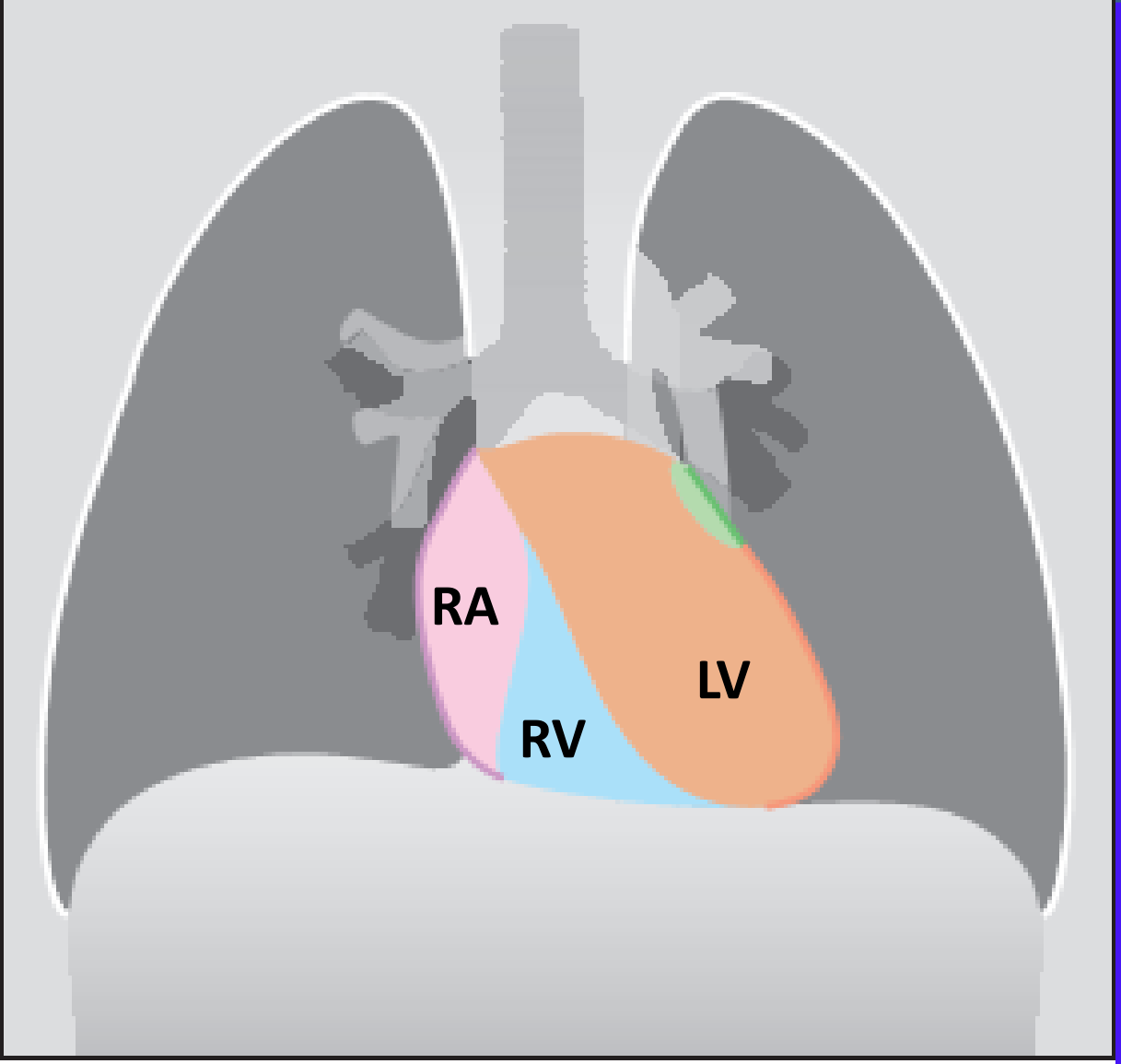
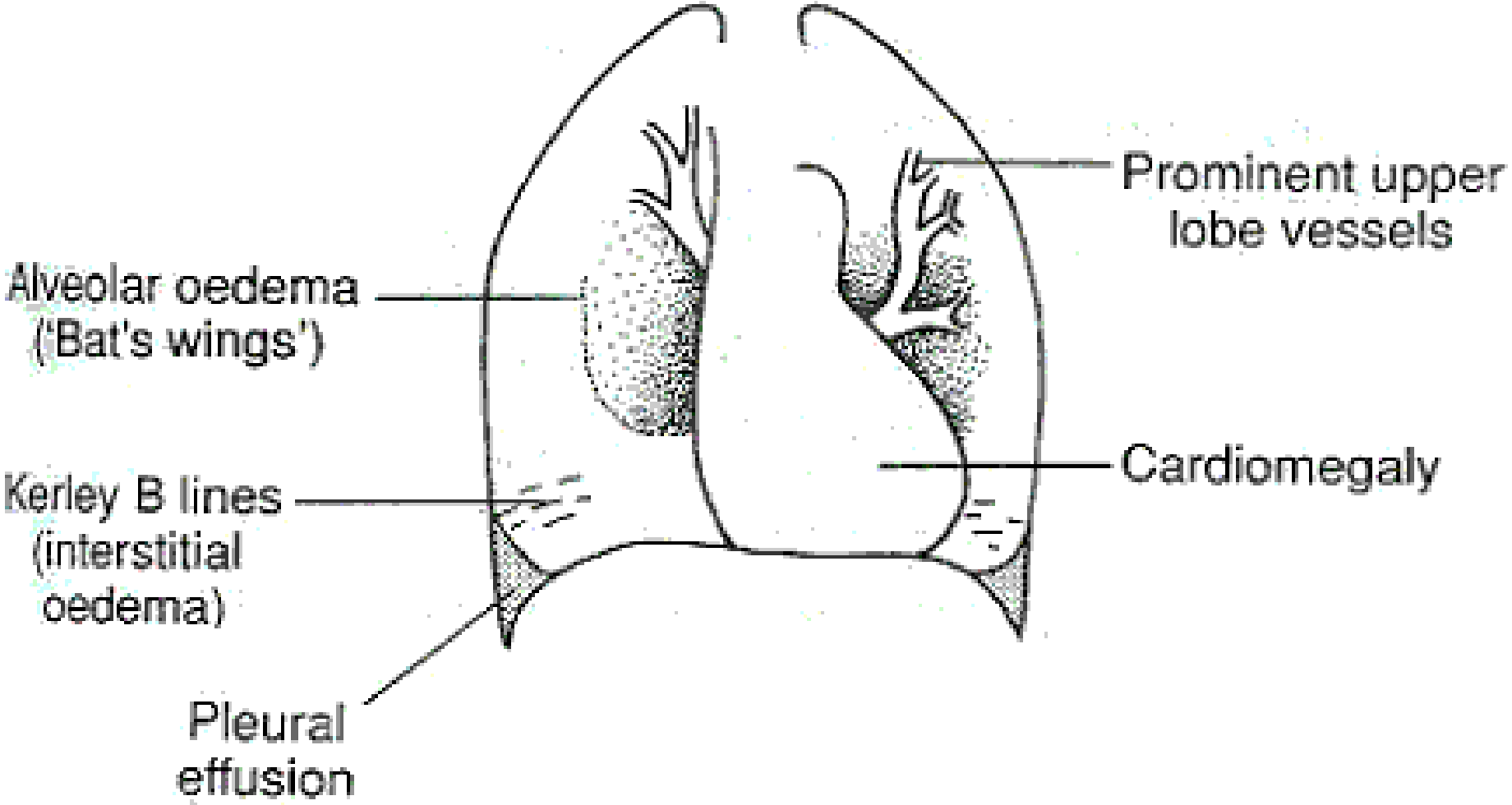
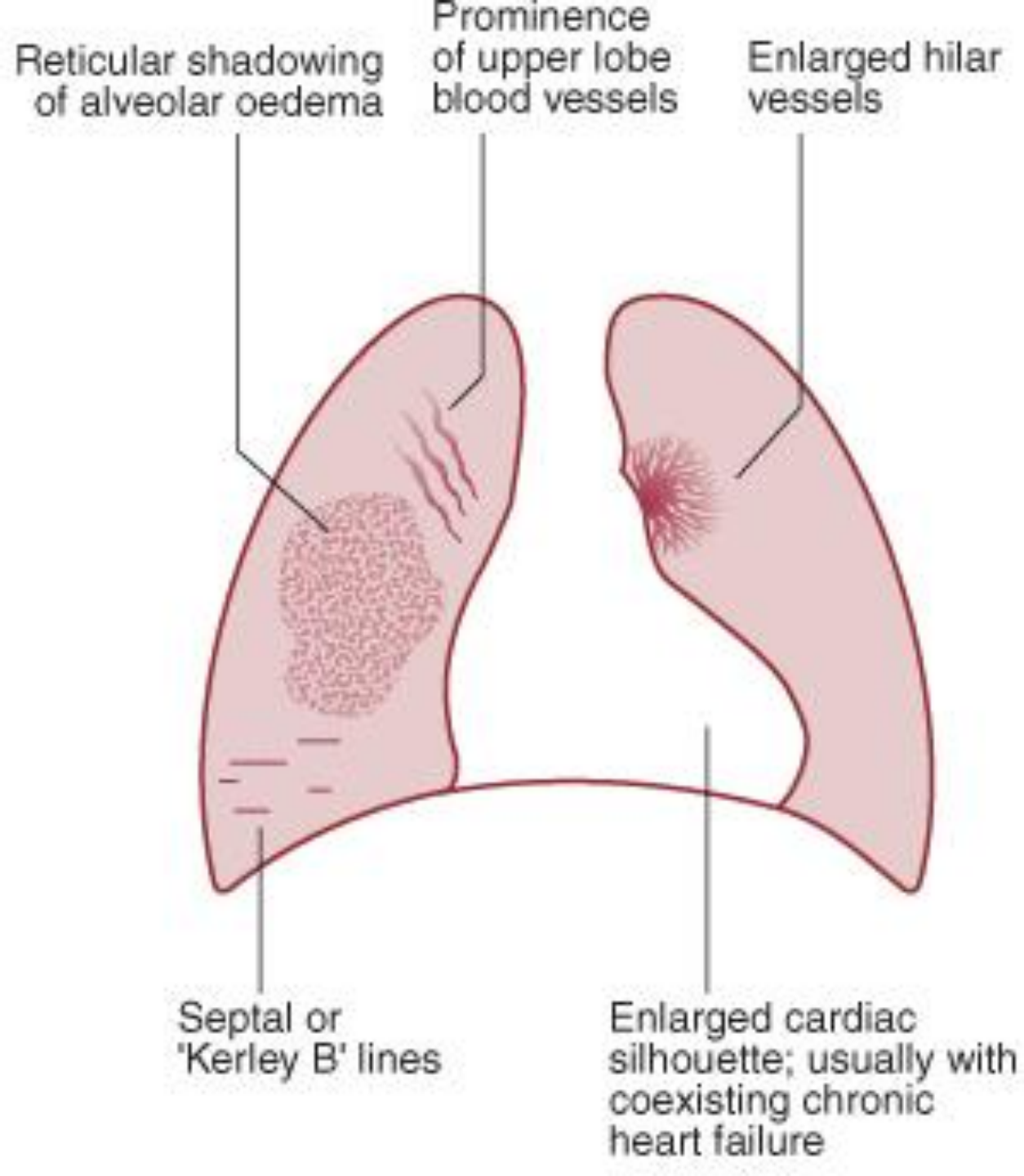
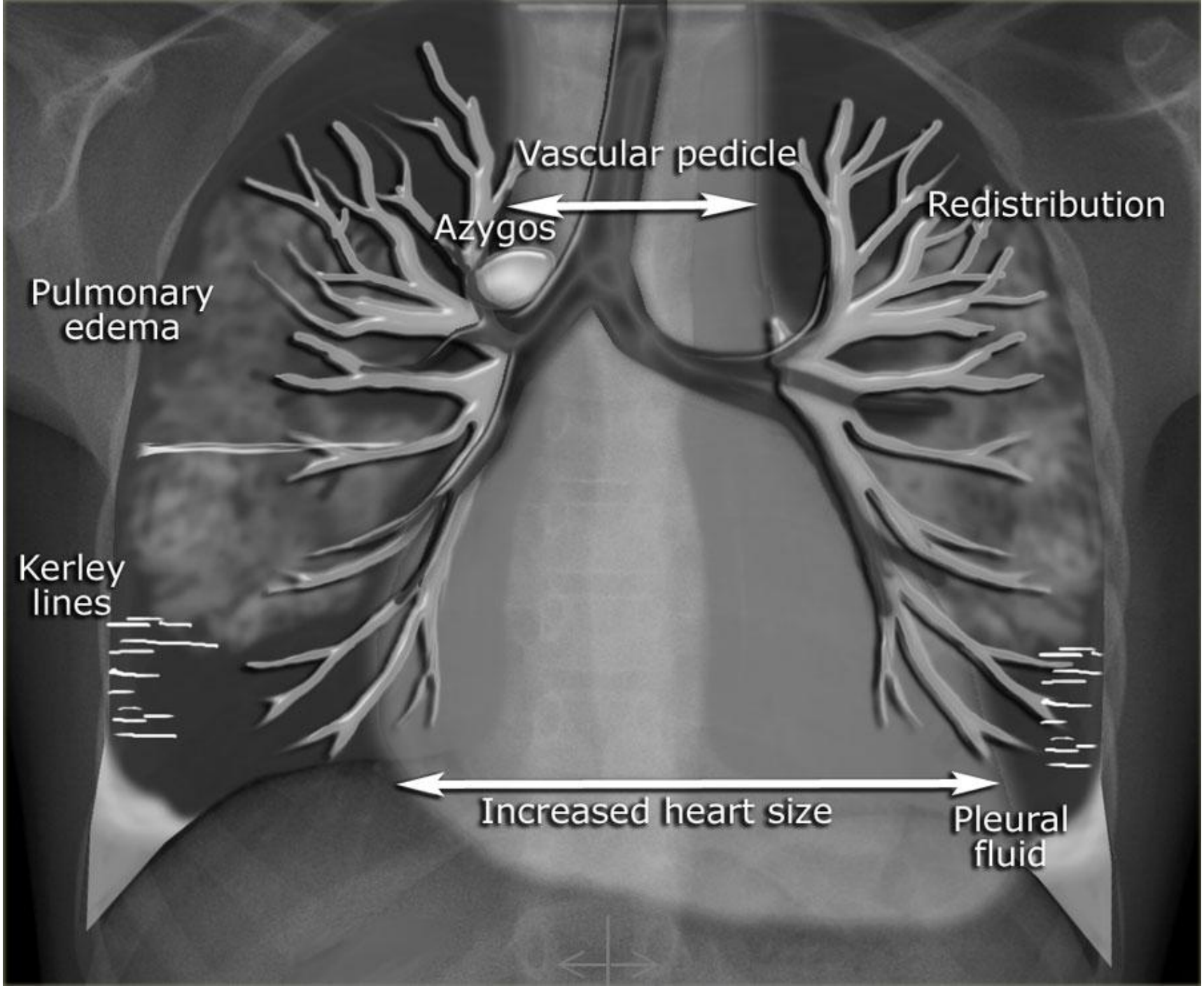


Figure 11.4 *The border-forming chambers: pink = right atrium; blue = right ventricle; brown = left ventricle.*

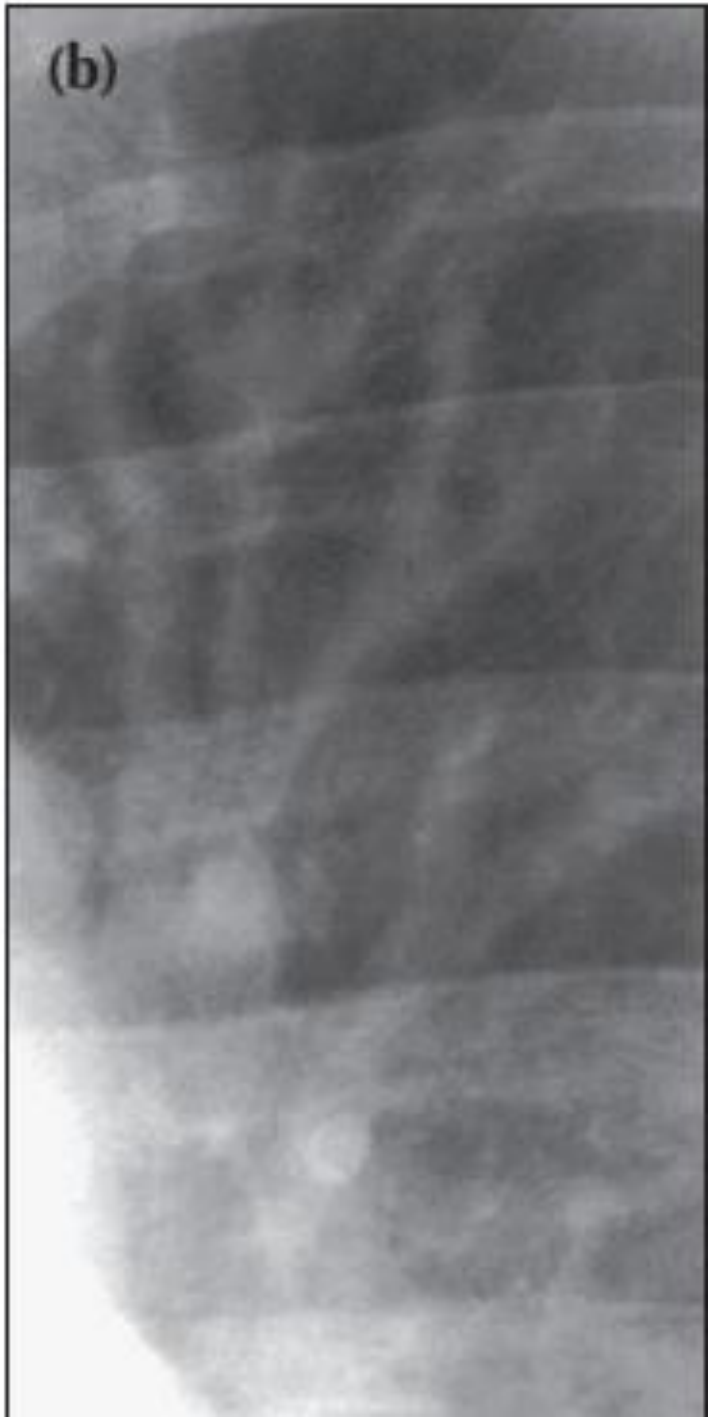


The CXR in left ventricular failure


Reticular shadowing of alveolar oedema
Prominence of upper lobe blood vessels
Enlarged hilar vessels
Septal or 'Kerley B' lines
Enlarged cardiac silhouette; usually with coexisting chronic heart failure


Vascular pedicle
Azygos
Redistribution
Pulmonary edema
Kerley lines
Increased heart size
Pleural fluid





Early LVF.
Change in size of the upper lobe vessels.
in (a):
The pulmonary venous pressure was normal
in (b),
prior to developing Å forid pulmonary oedema. Venous pressure is increased

The upper lobe vessels are dilated in (b) as compared
with (a)



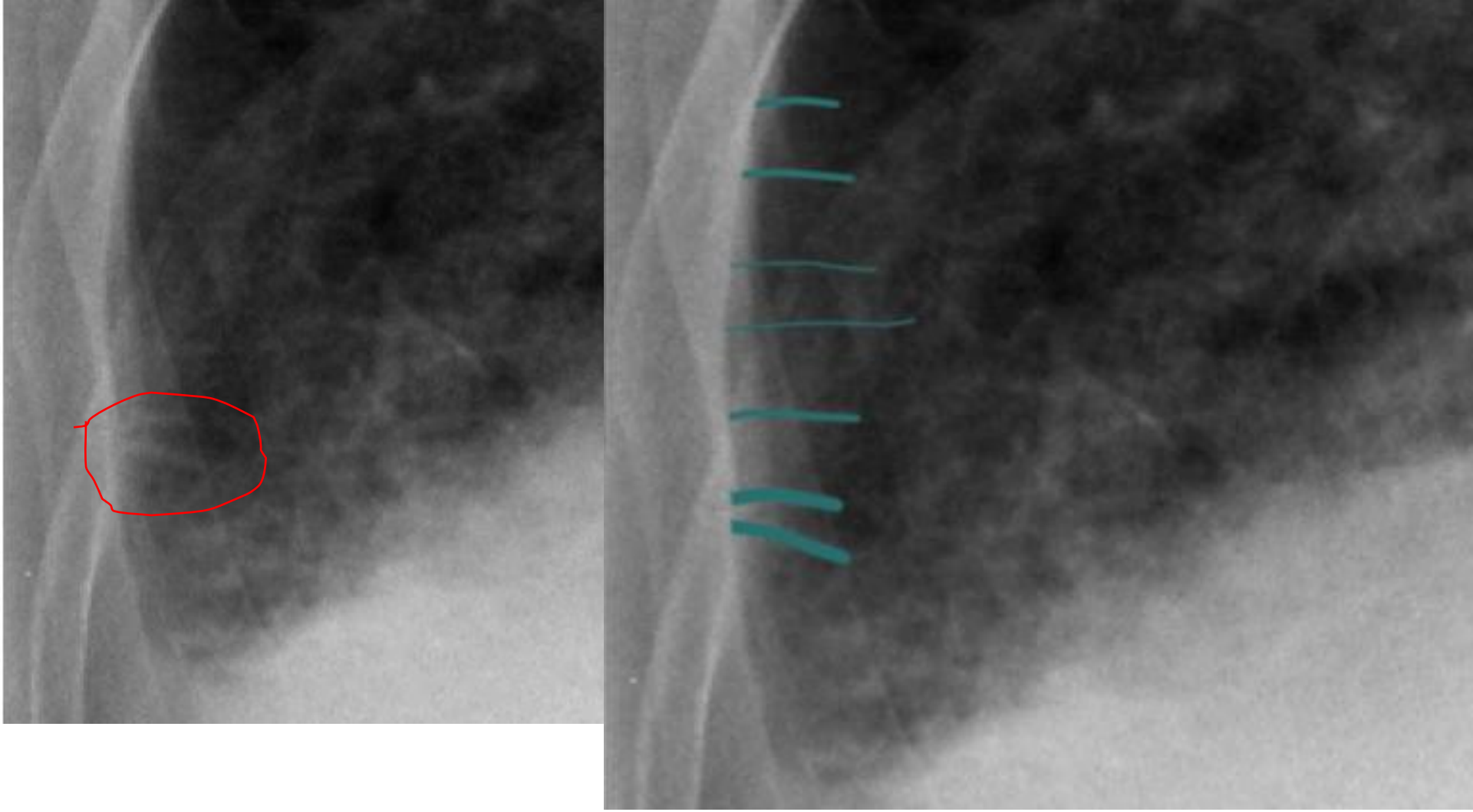
Stage 1 left heart failure. *Raised pulmonary venous pressure*. Note the bilateral upper lobe blood diversion (arrowheads).



Stage 2 left heart failure. *Interstitial pulmonary oedema*. Prominent septal lines at the right costophrenic angle.

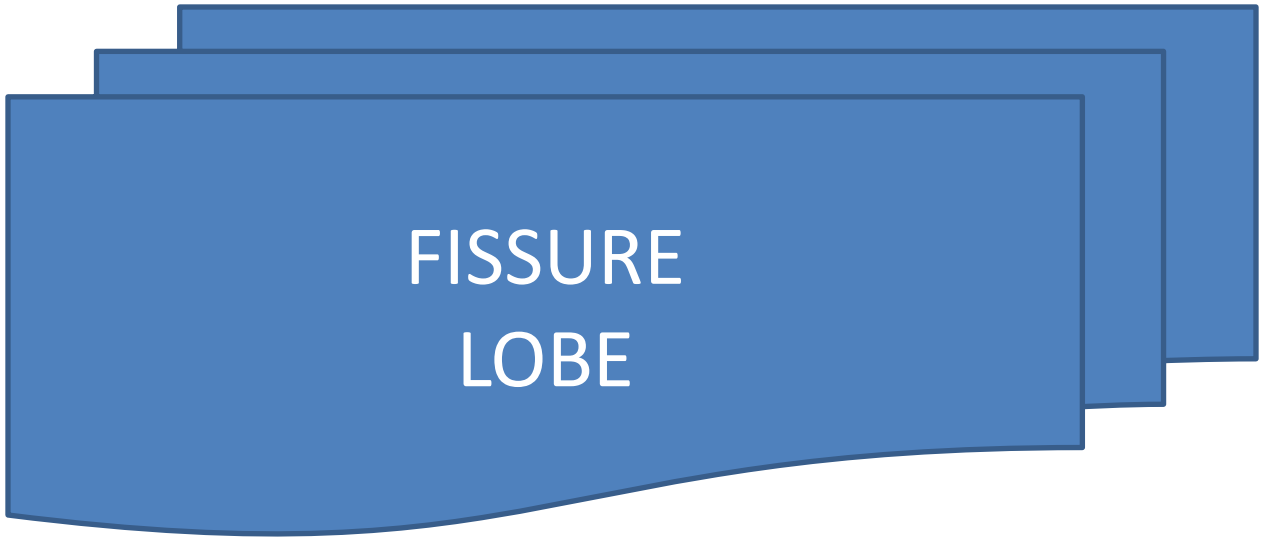


'Kerley B' lines (arrow).



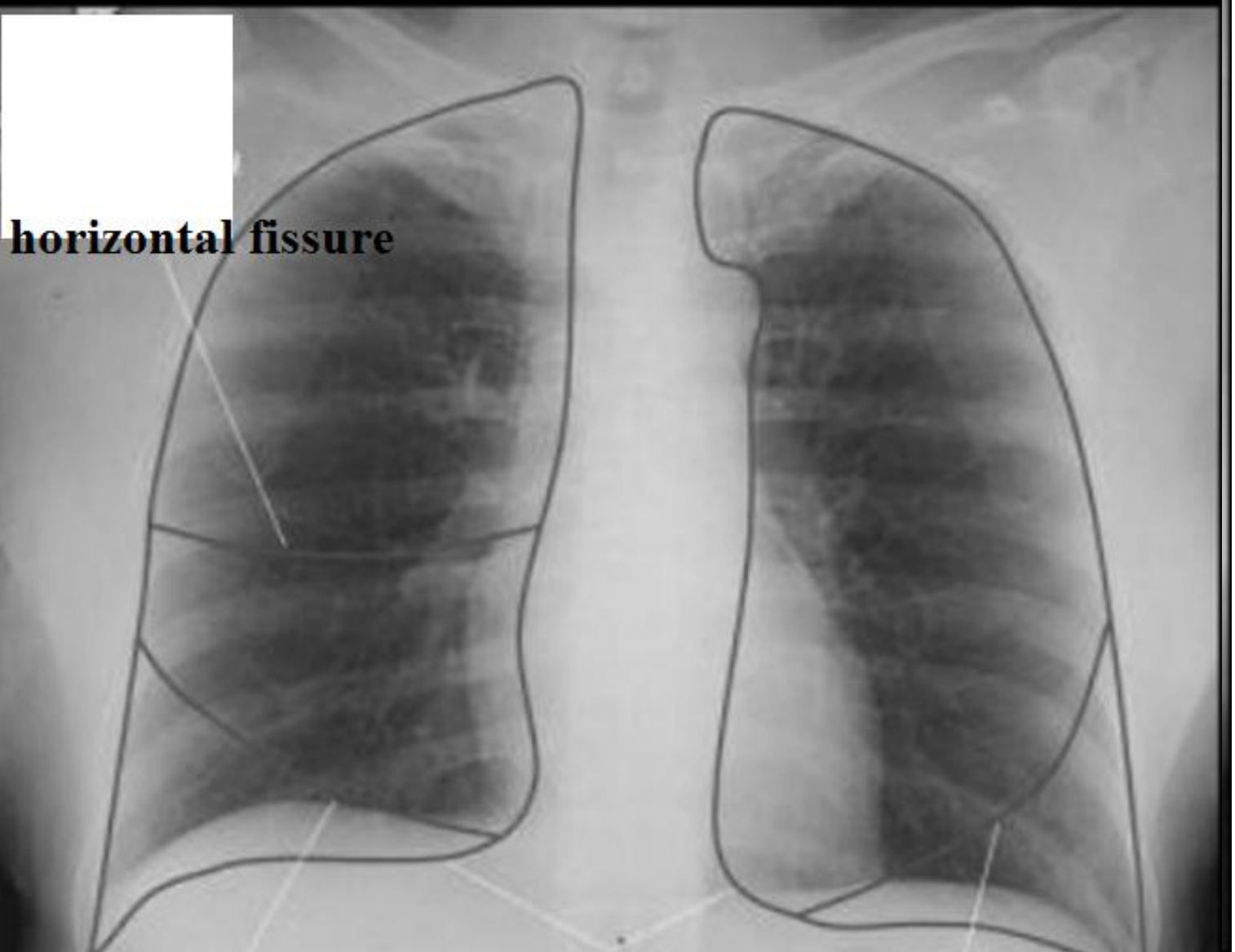
Septal lines (Kerley B lines)

Horizontal lines reaching the lung edge

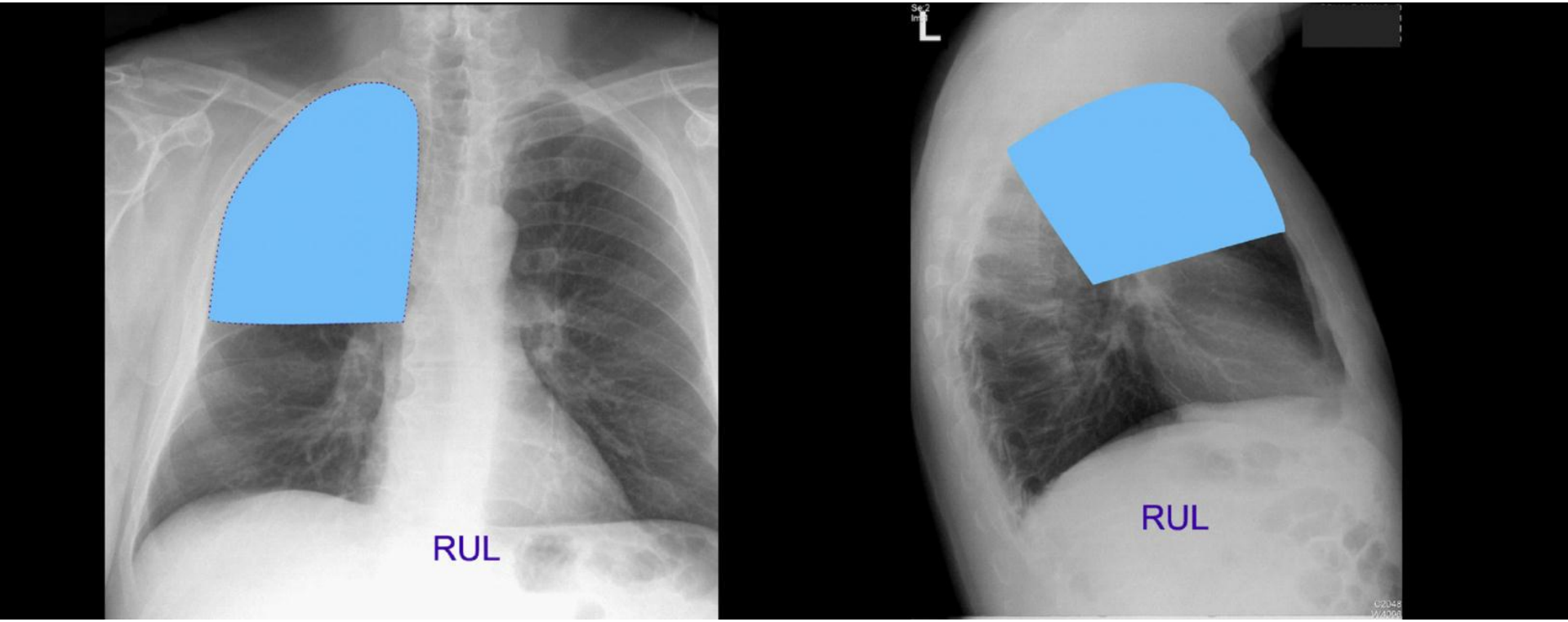

FISSURE
LOBE

Lung Fissures

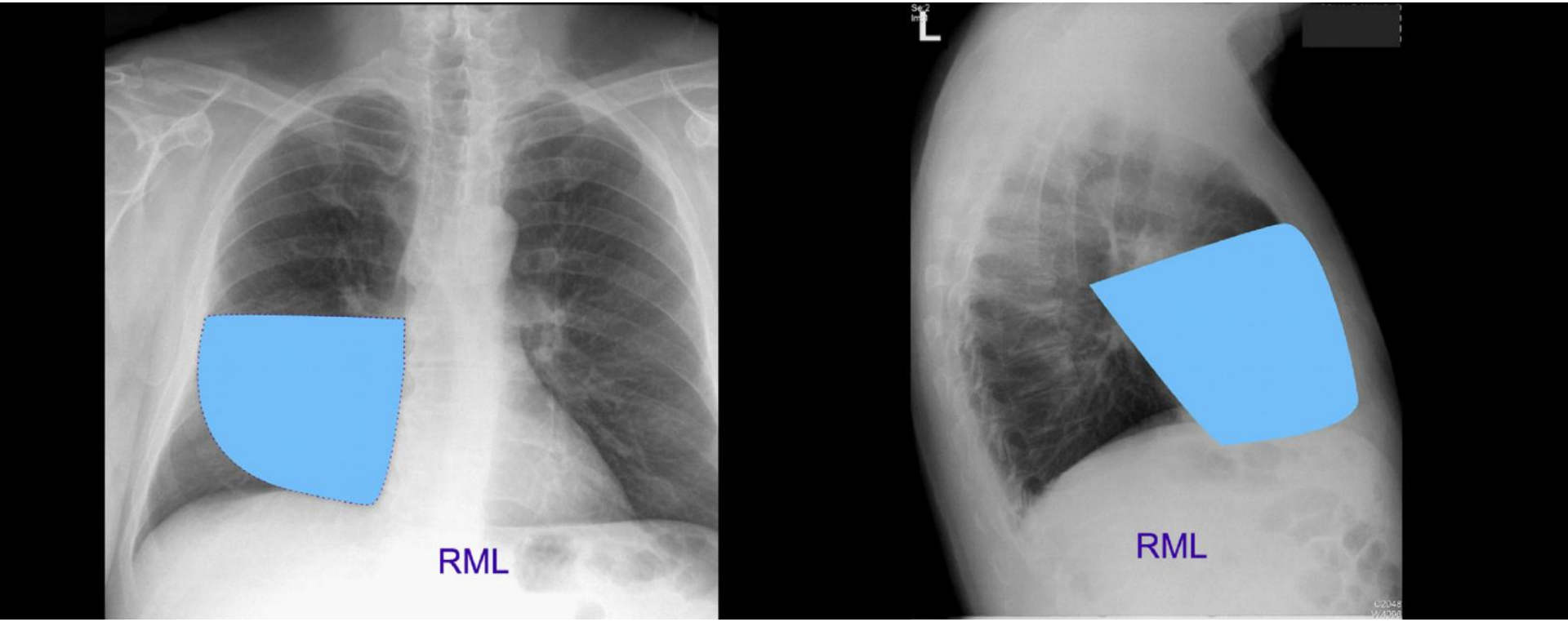
Lung Fissures



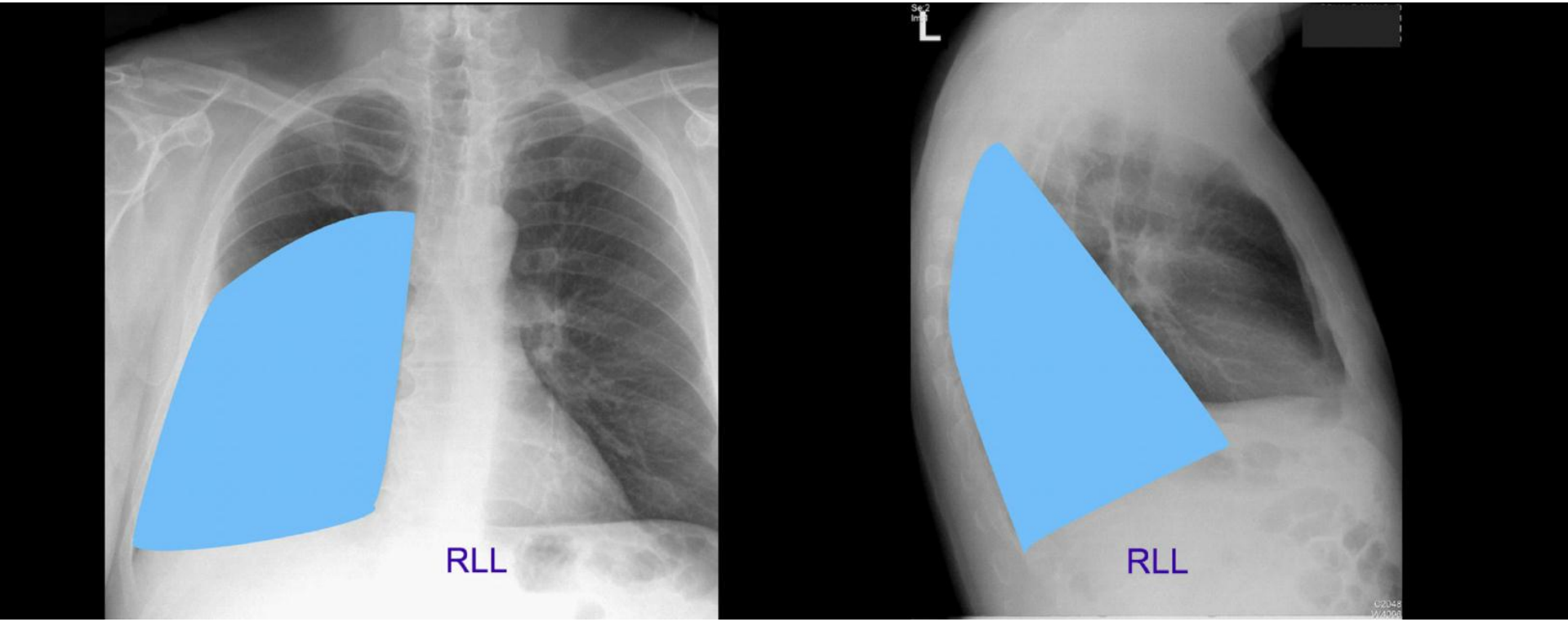
Lobes



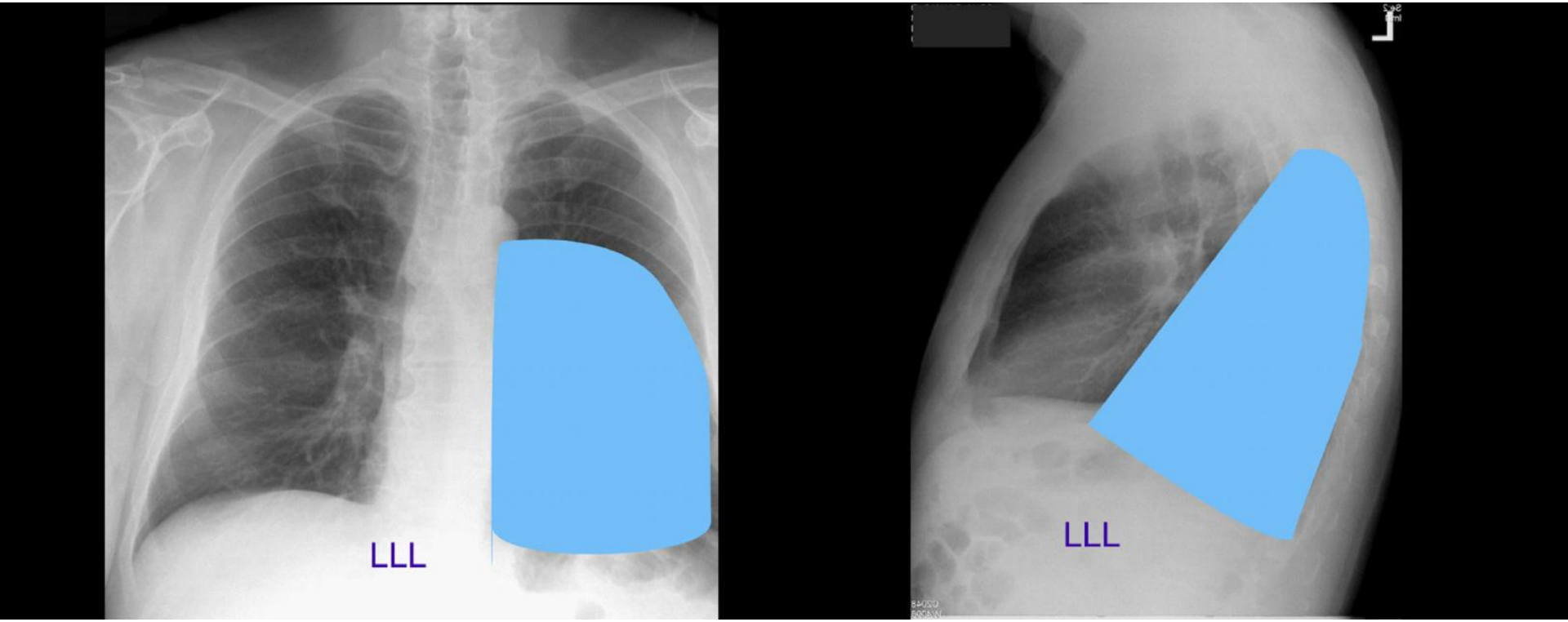
Lobes (continued)



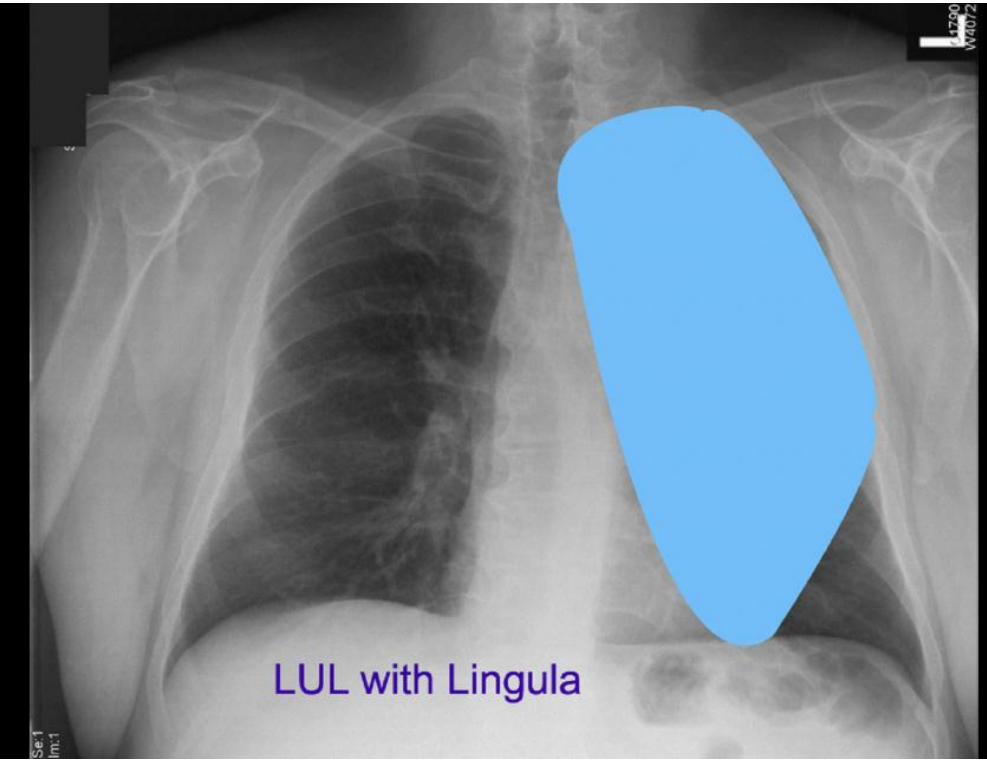
Lobes (continued)

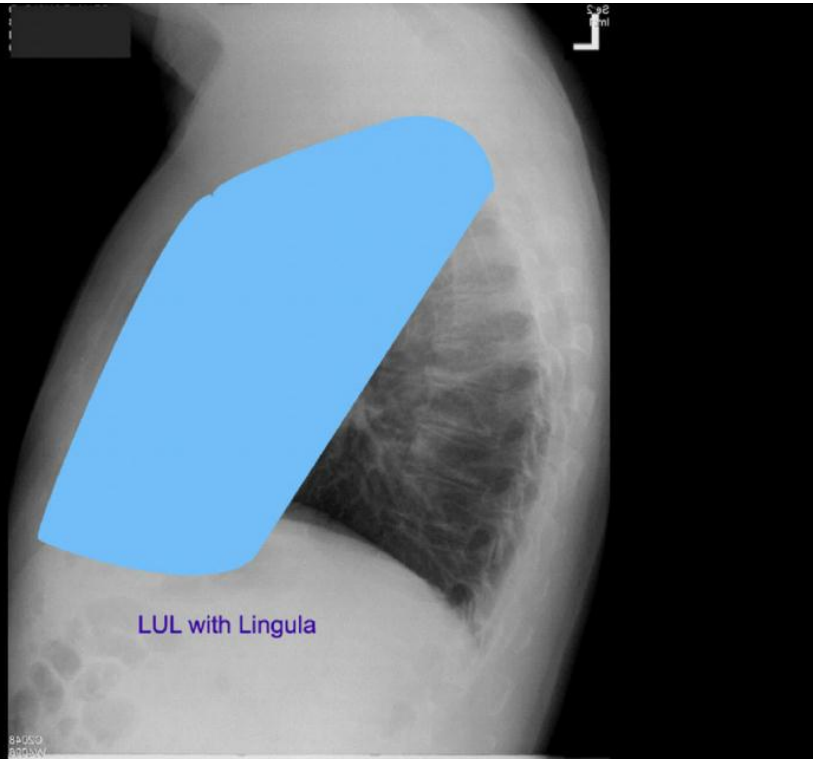


Lobes (continued)

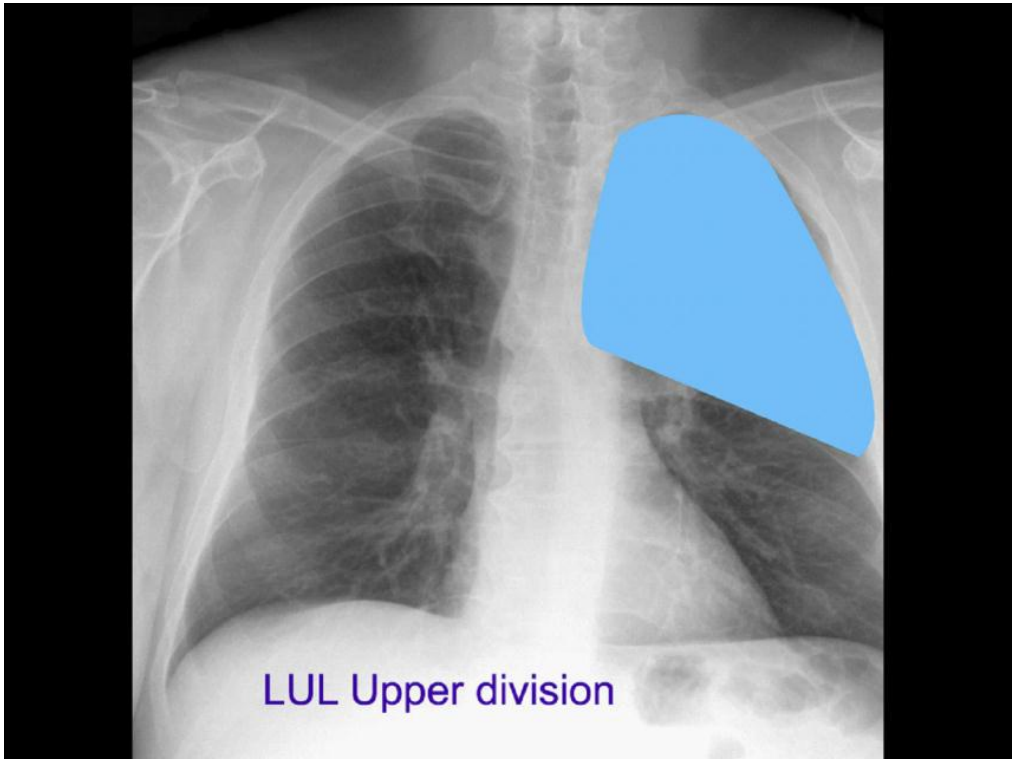


Lobes (continued)

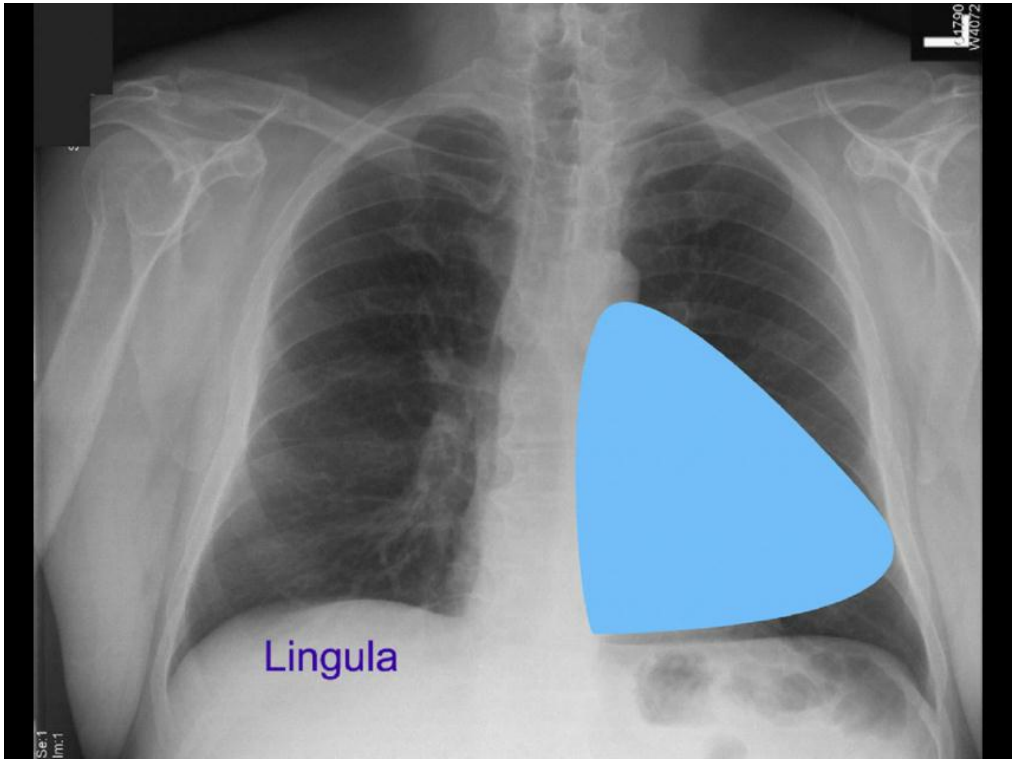




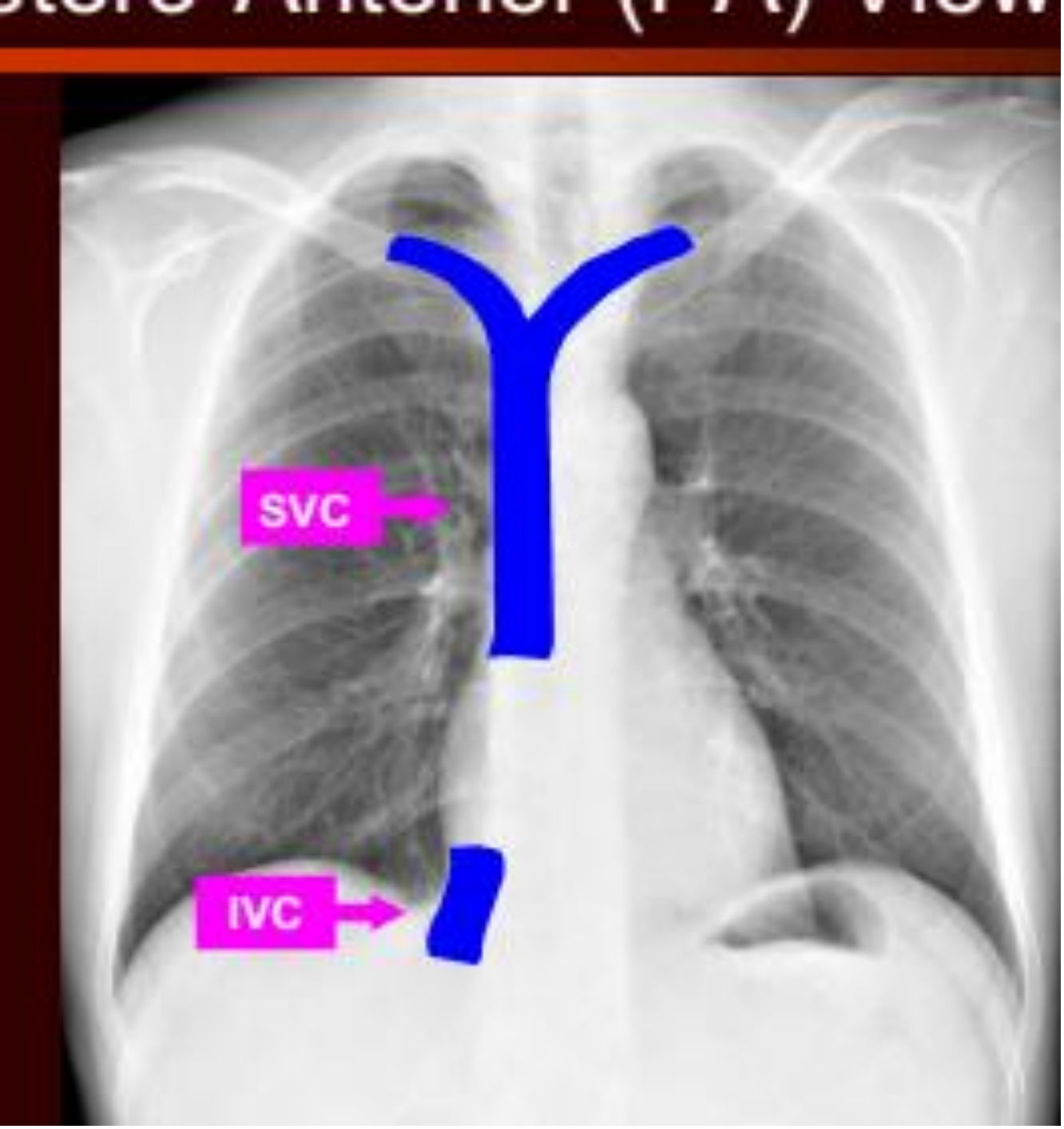
Lobes (continued)

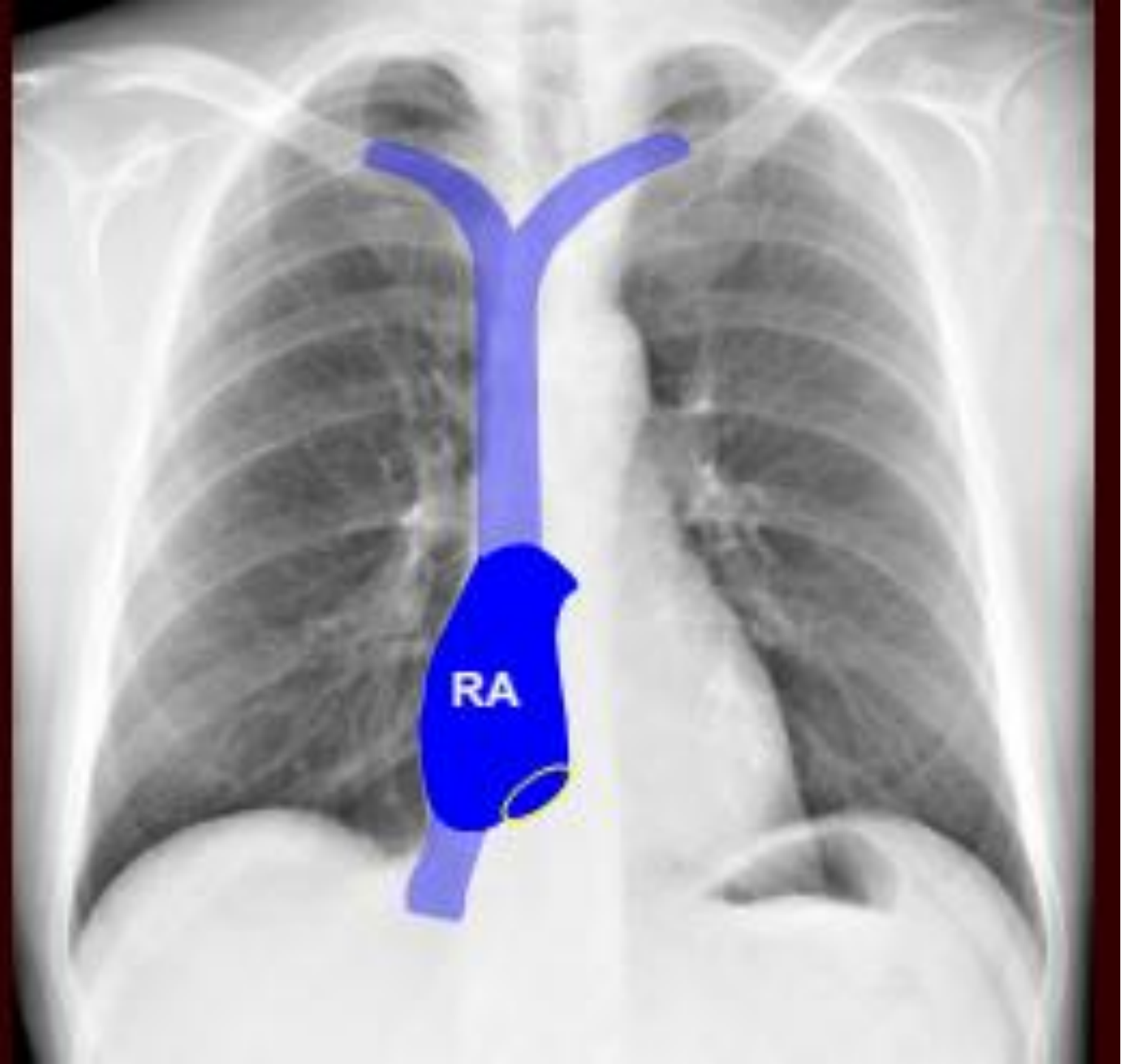


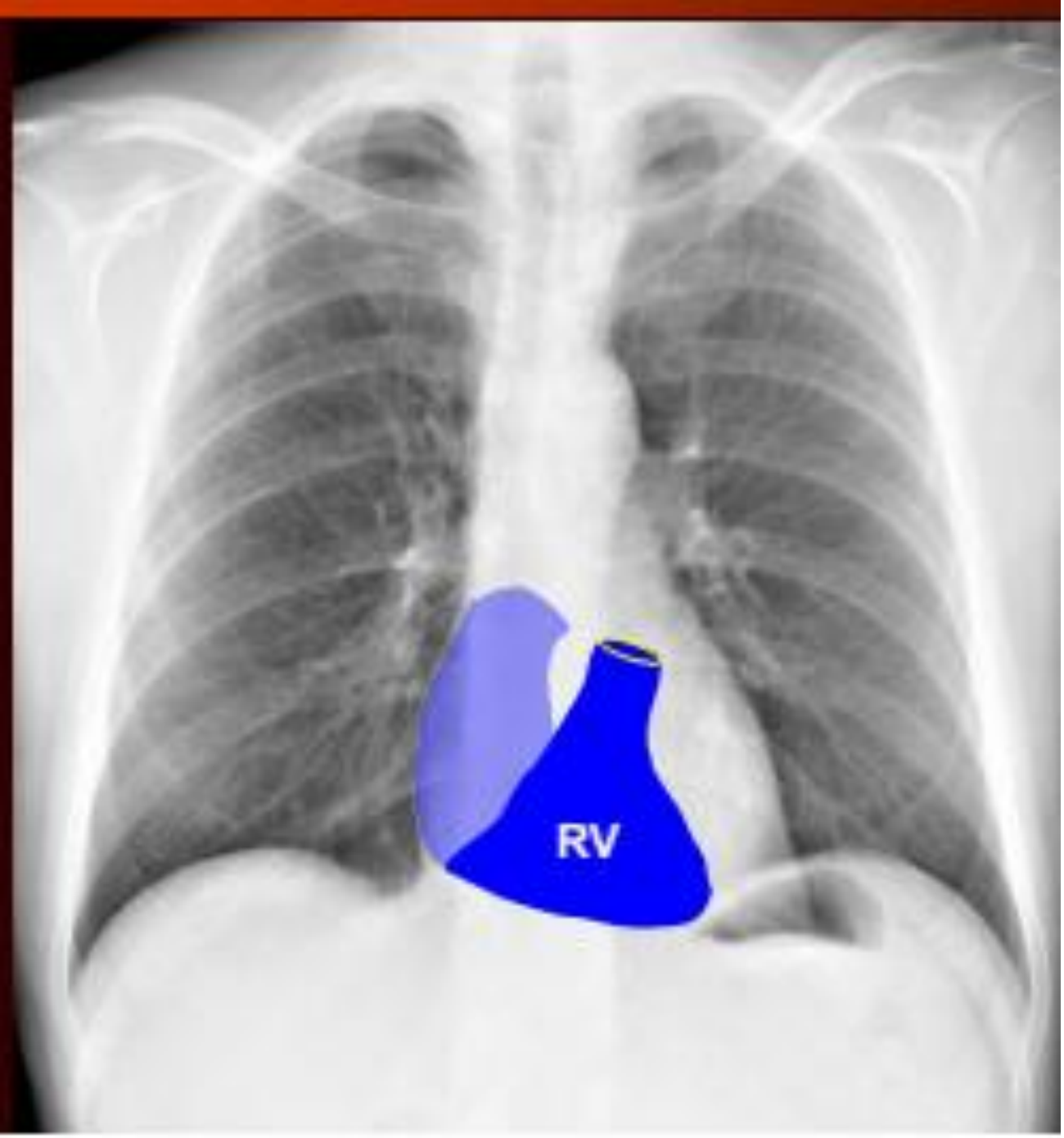
Lobes (continued)

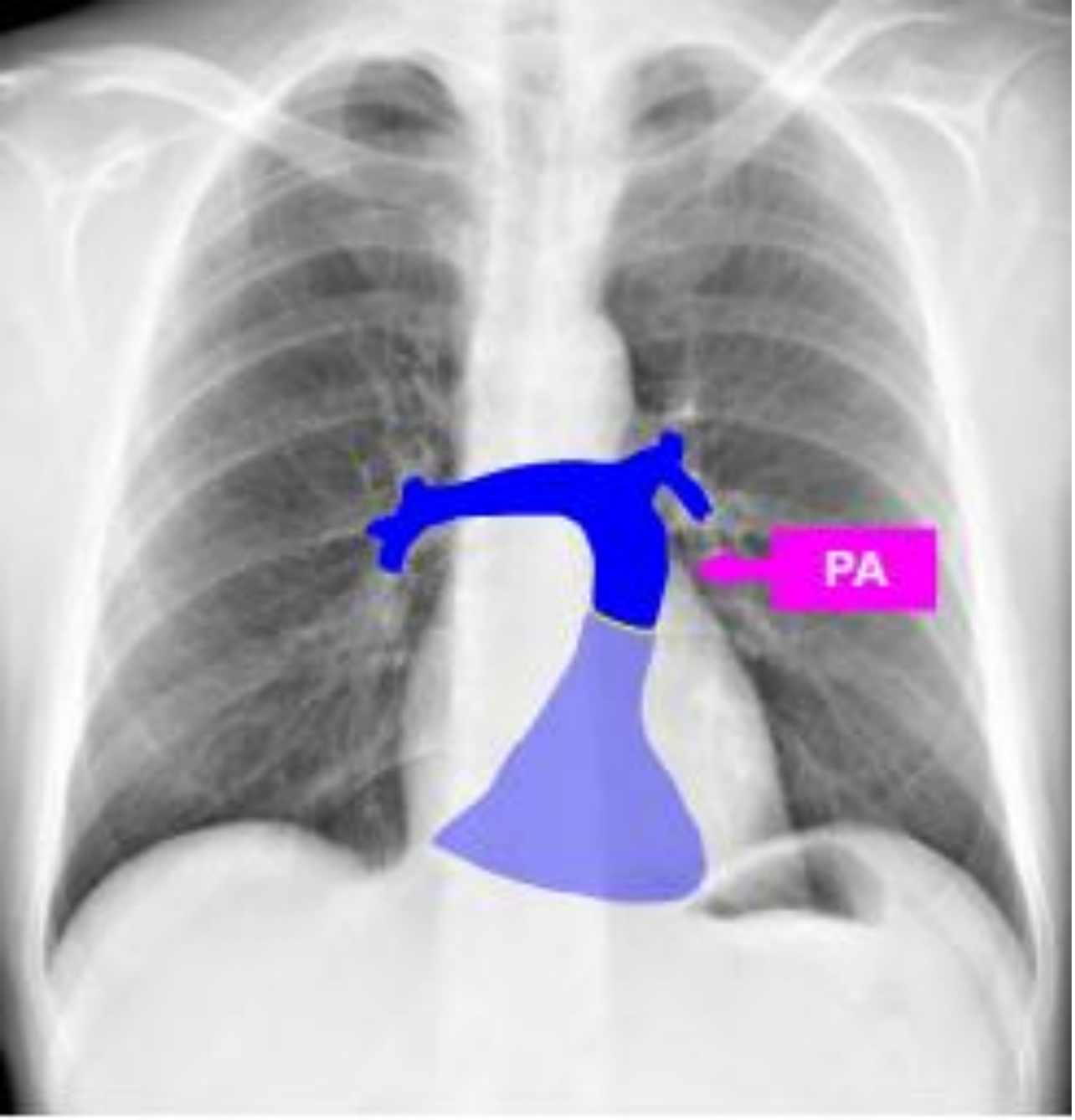


AT A GLANCE
HEART
&
VESSEL


SVC
IVC

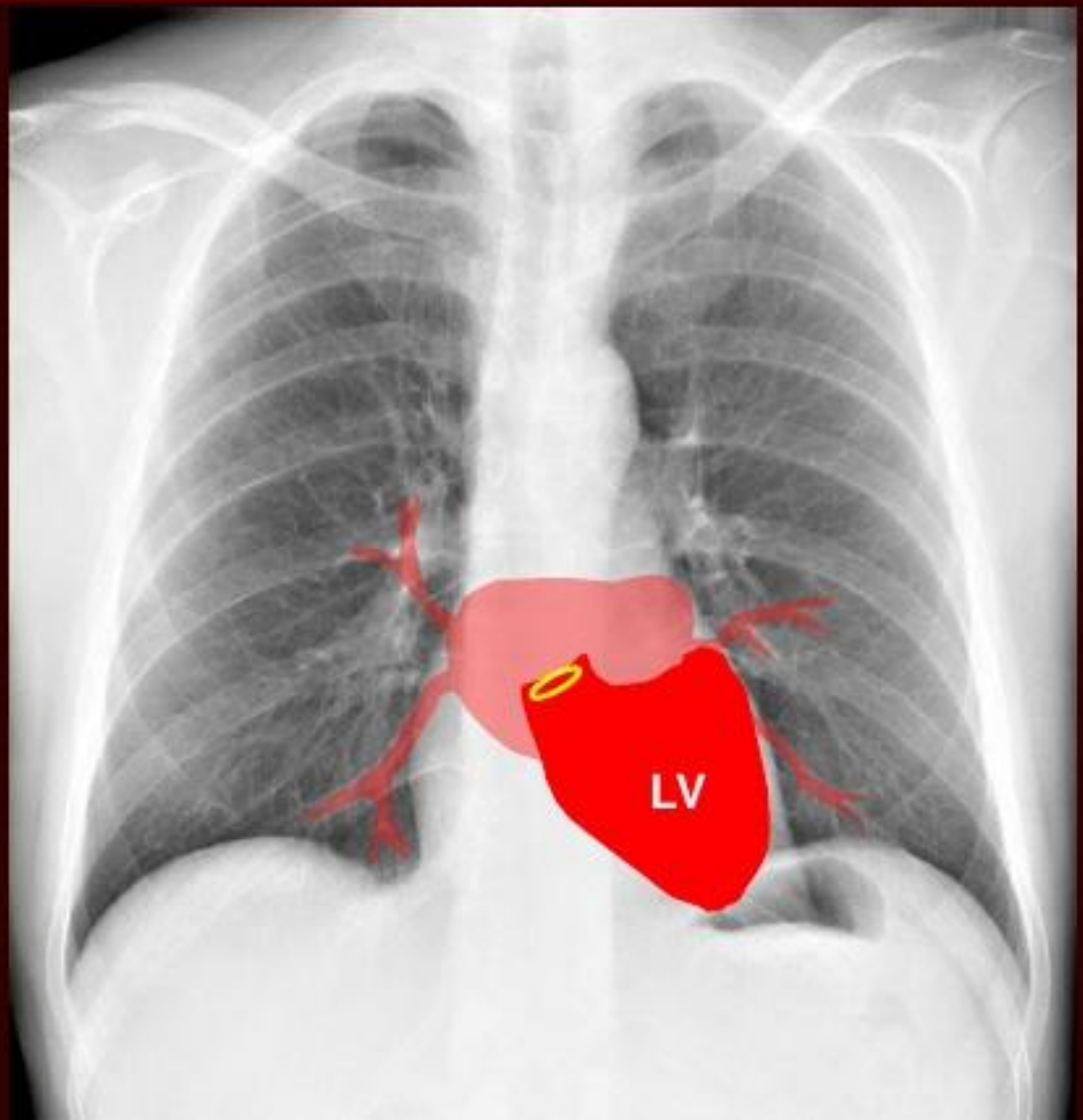

RA


RV

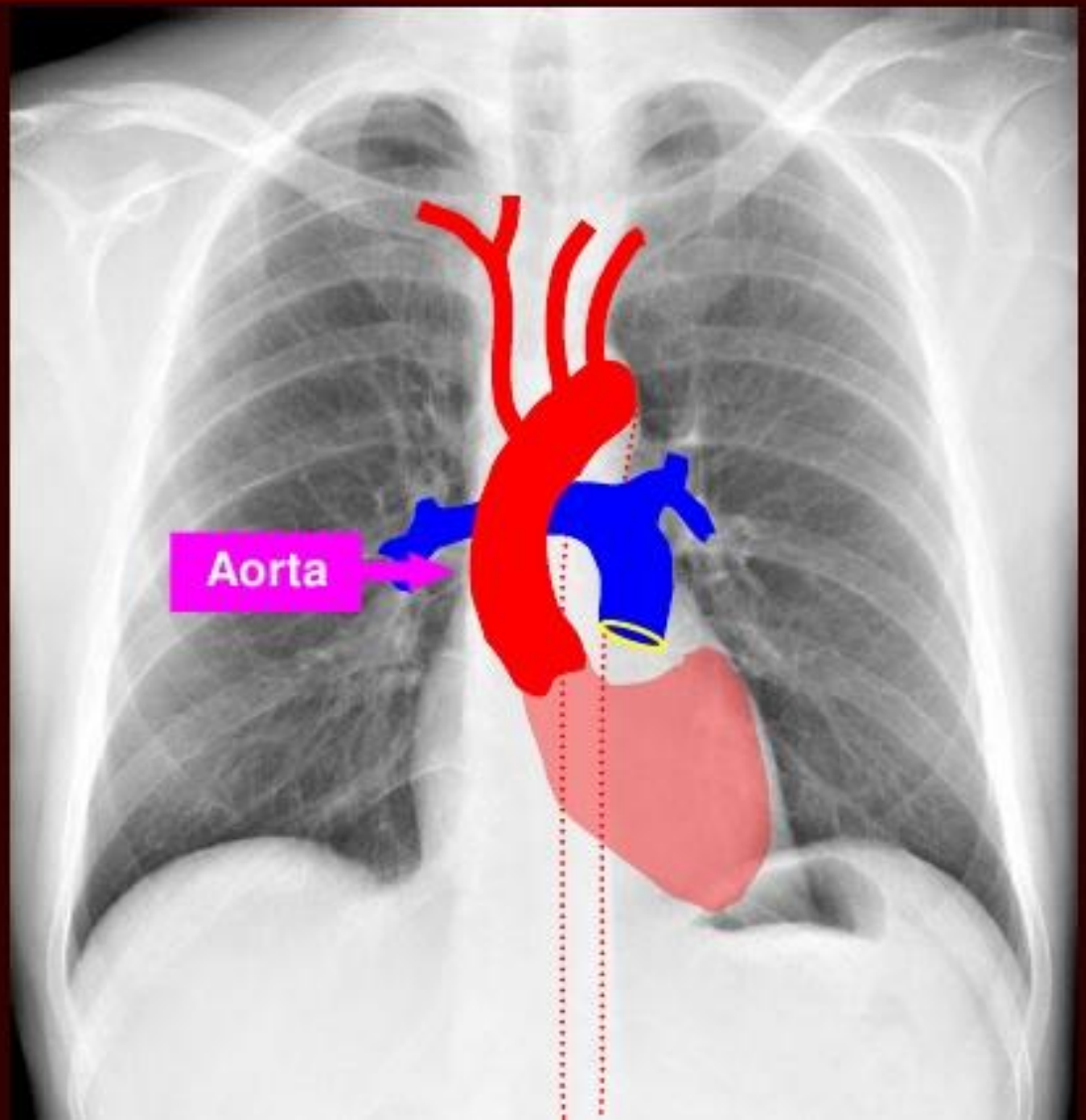

PA


LA

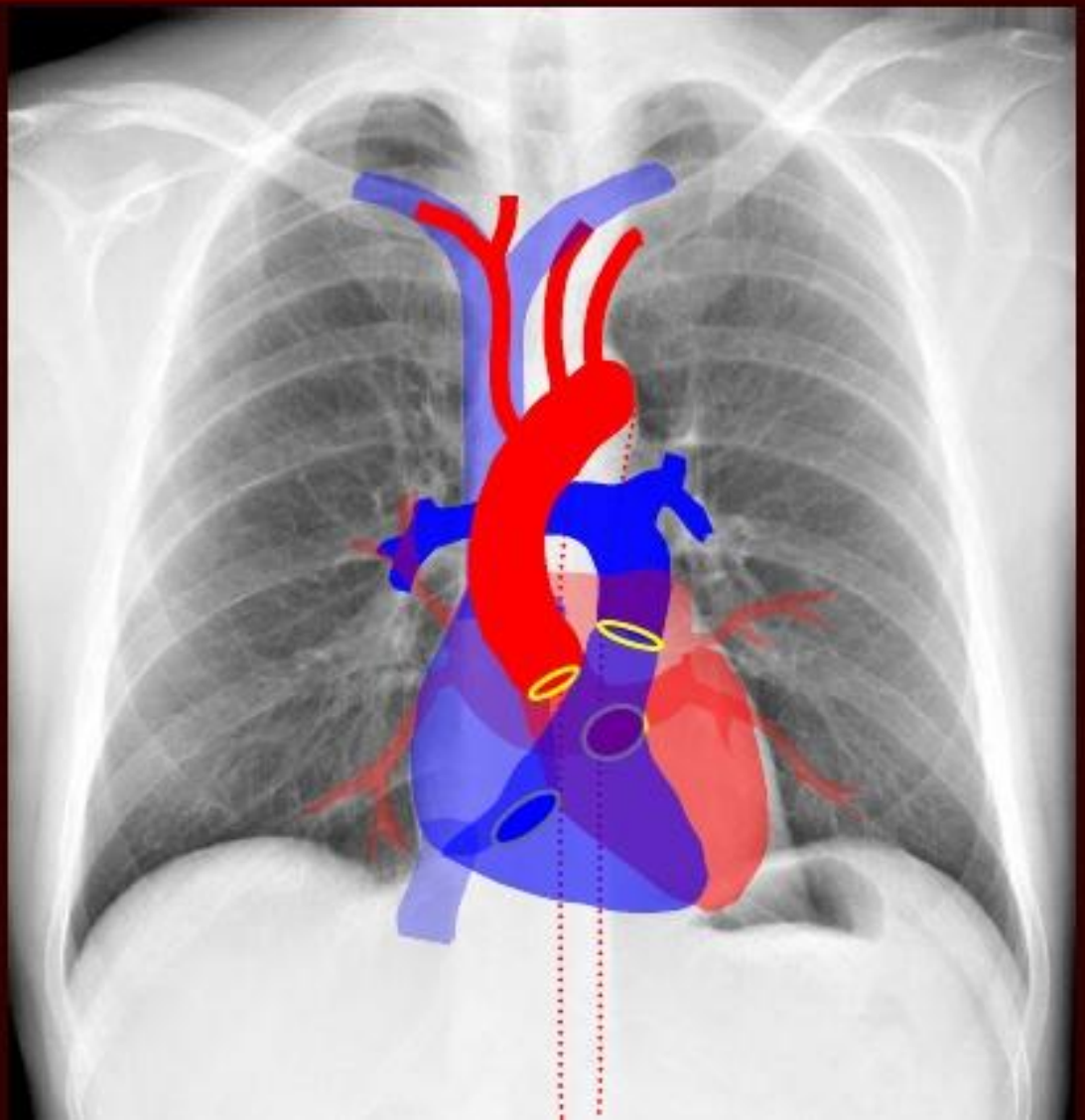
Postero-Anterior (PA) View



Postero-Anterior (PA) View

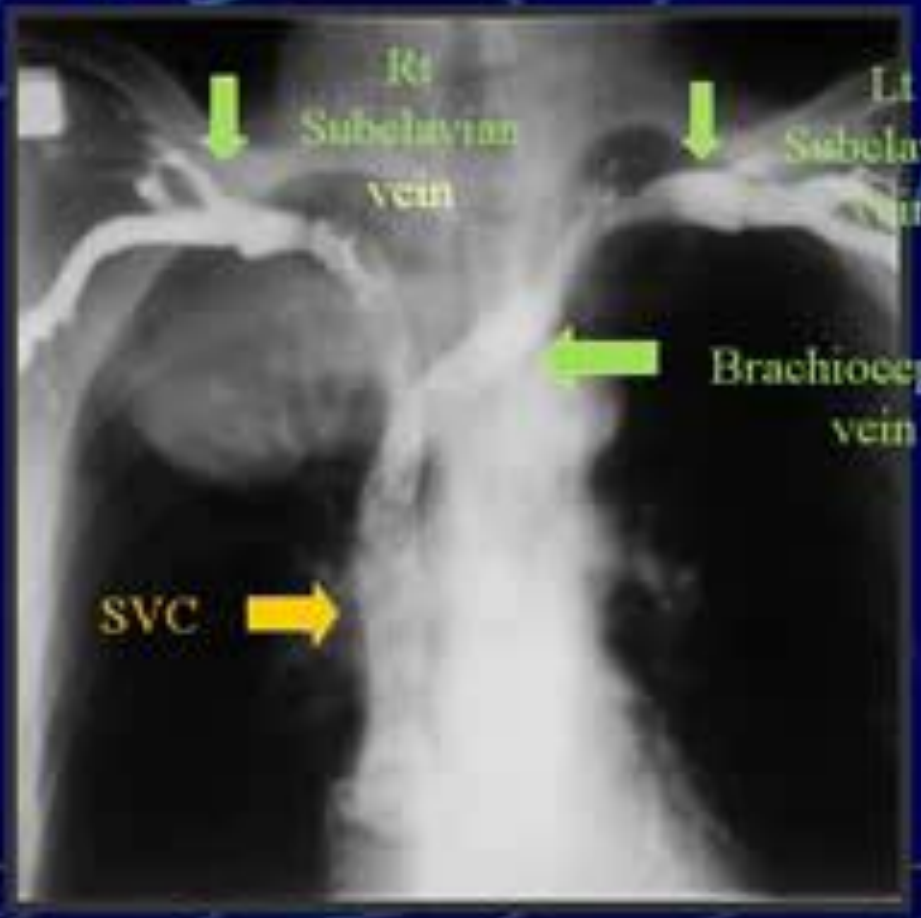


Postero-Anterior (PA) View

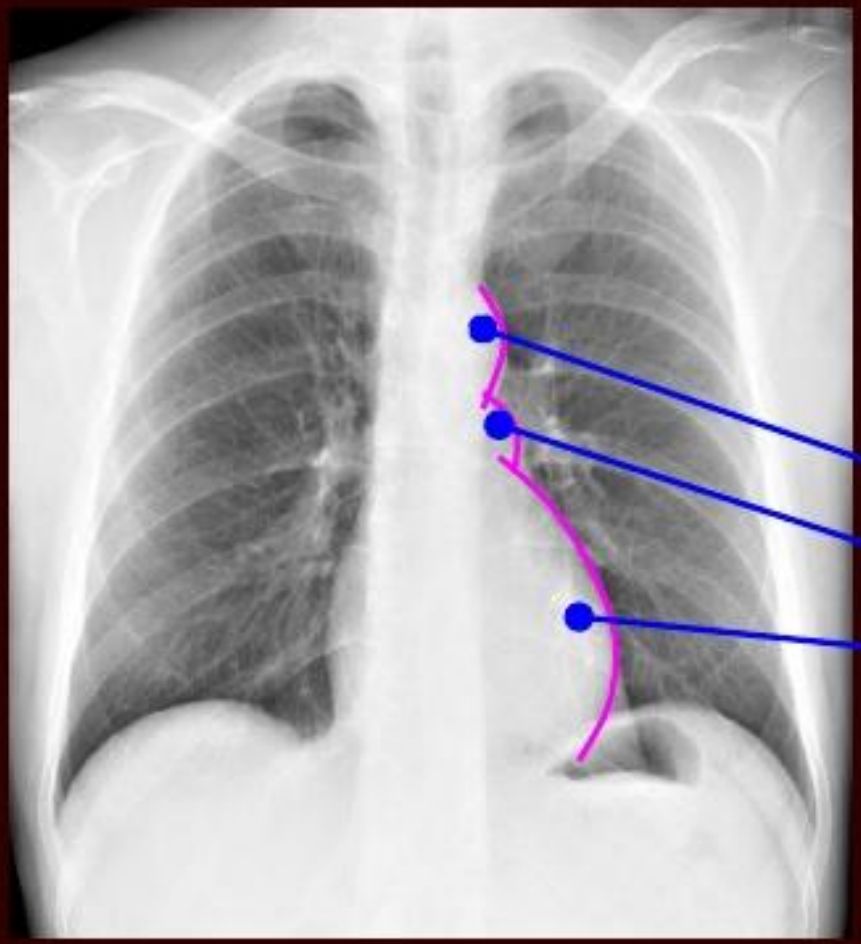



Right
para-tracheal
stripe
Azygos
vein

Superior Vena Cava

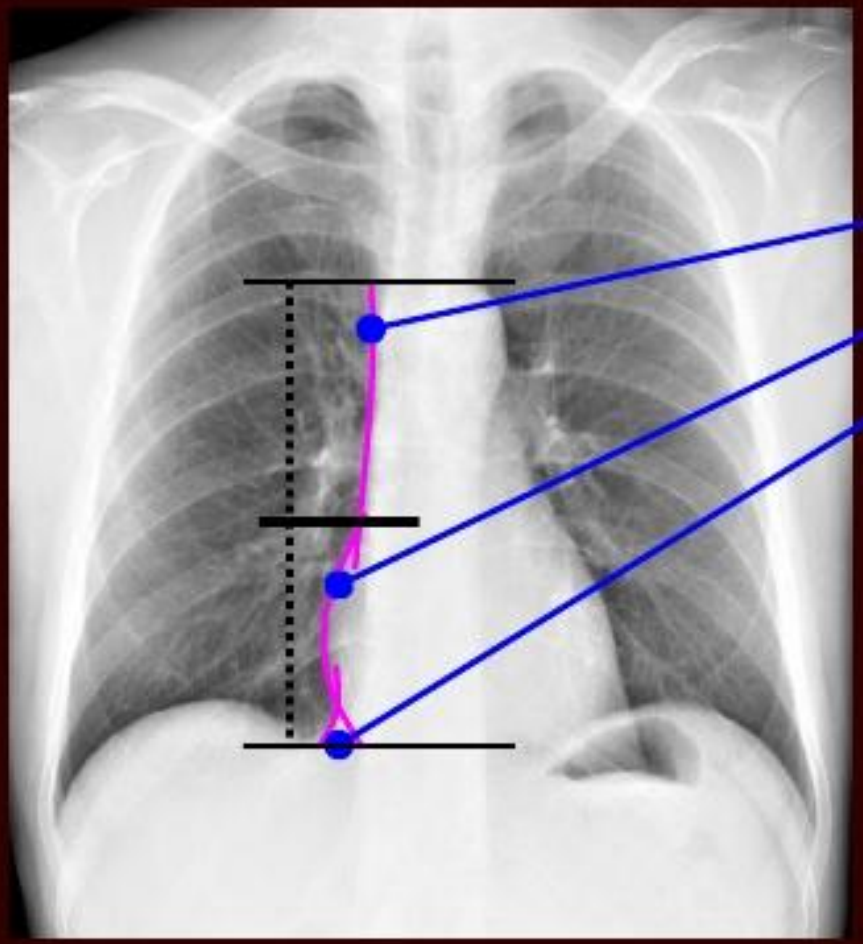


Postero-Anterior (PA) View



- Right border
  - Superior vena cava
  - Right atrium
  - Inferior vena cava
- Left border
  - Aortic knob
  - Main pulmonary trunk
  - Left ventricle

Postero-Anterior (PA) View



- Right border
  - Superior vena cava
  - Right atrium
  - Inferior vena cava

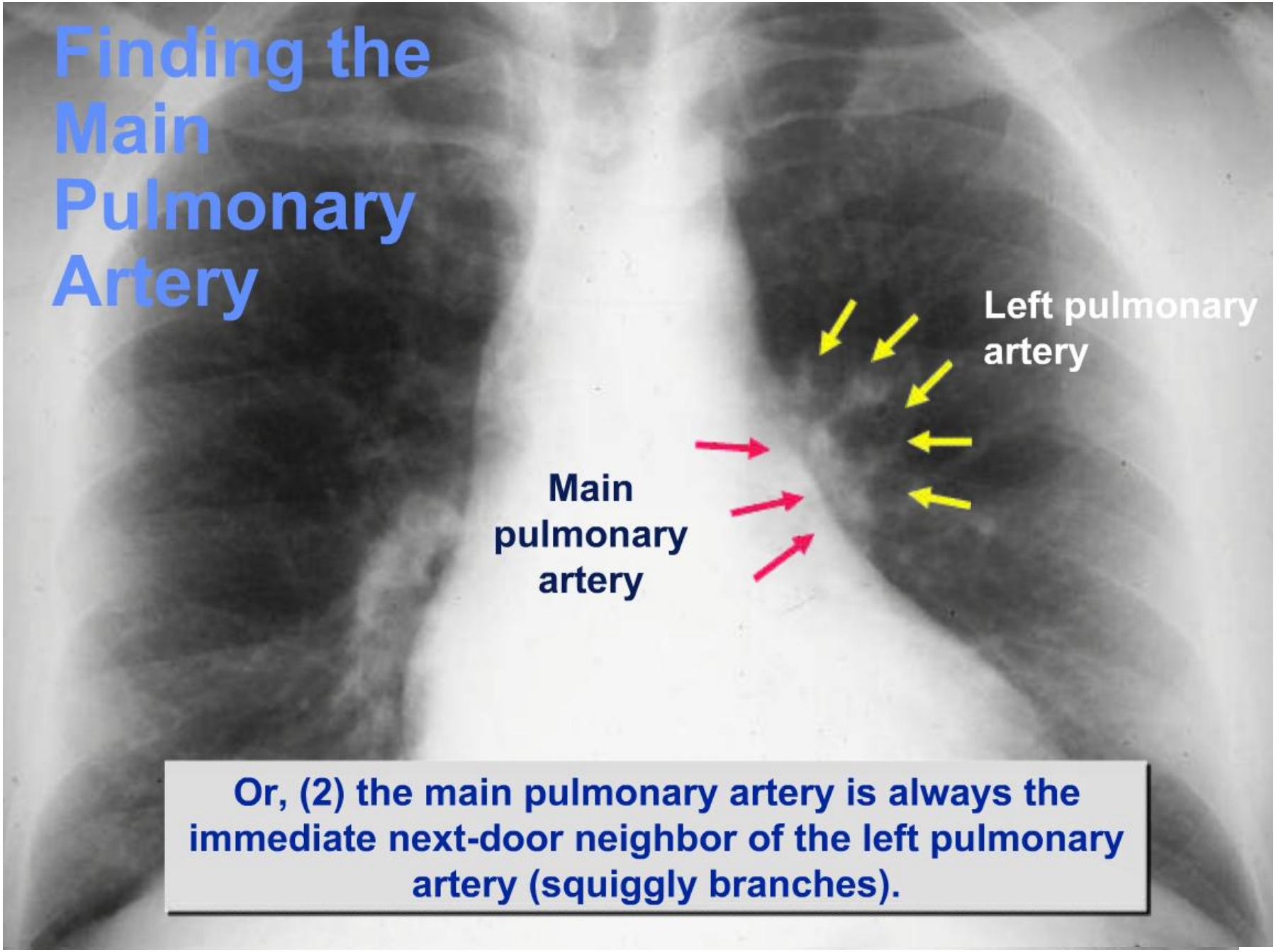
Pulmonary circulation



Pulmonary arteries are usually easily visible centrally in the hila and progressively less so more peripherally.

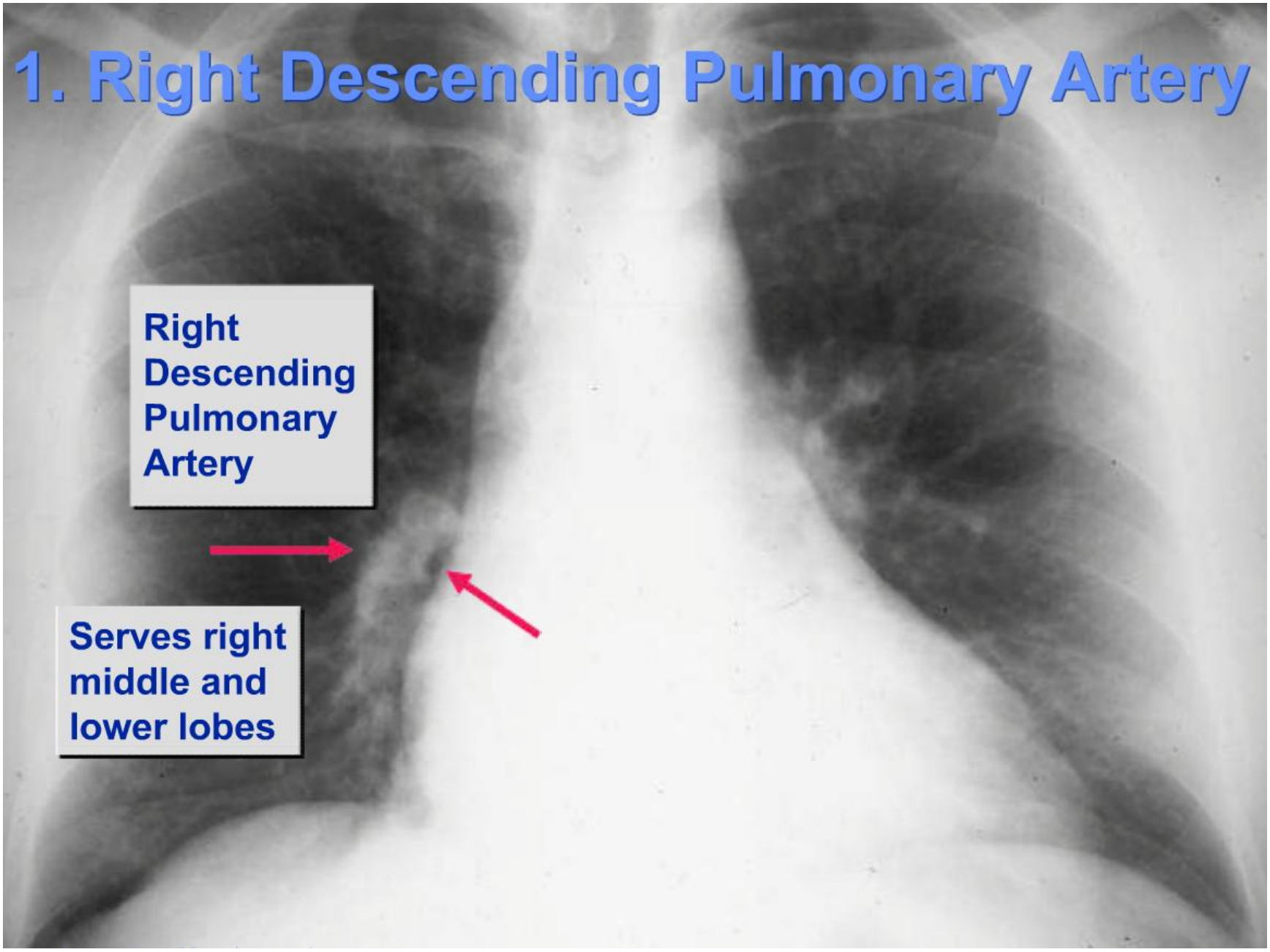
Dr. SHAMOL/Radio logy

Finding the Main Pulmonary Artery



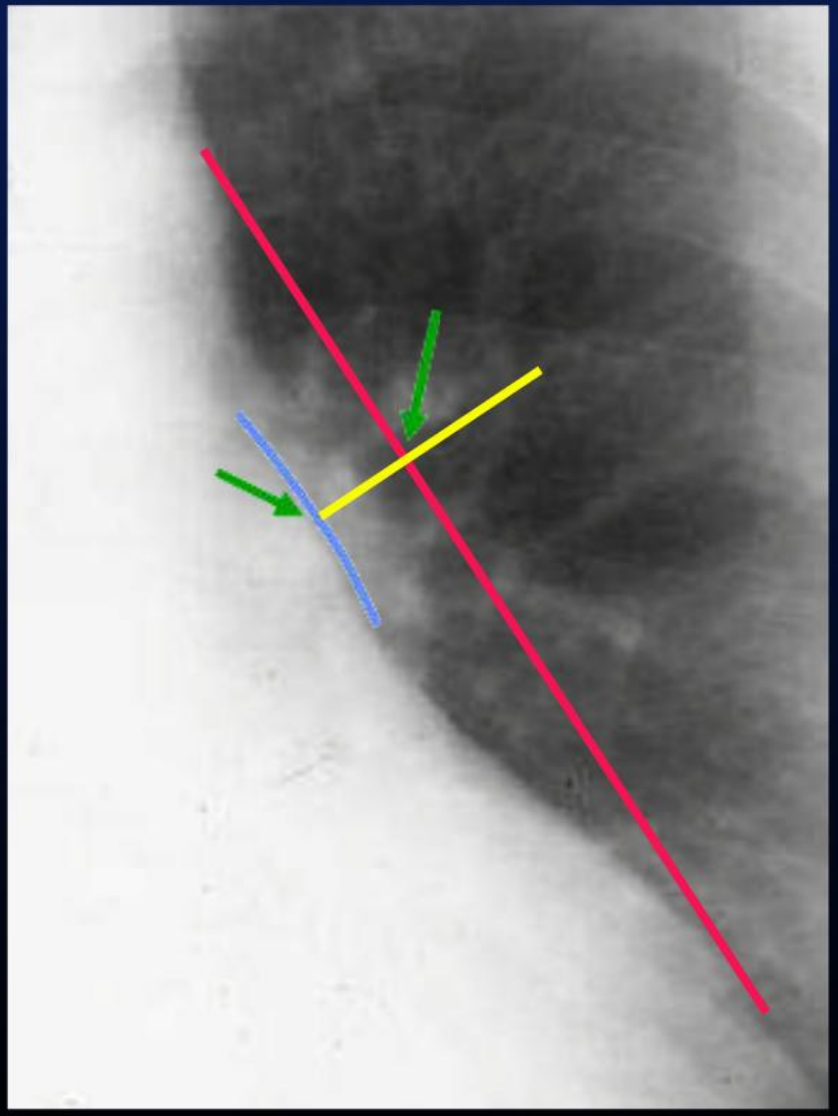
Or, (2) the main pulmonary artery is always the immediate next-door neighbor of the left pulmonary artery (squiggly branches).

1. Right Descending Pulmonary Artery



We can measure the main pulmonary artery . . .

If we draw a tangent line from the apex of the left ventricle to the aortic knob (red line) and measure along a perpendicular to that tangent line (yellow line)



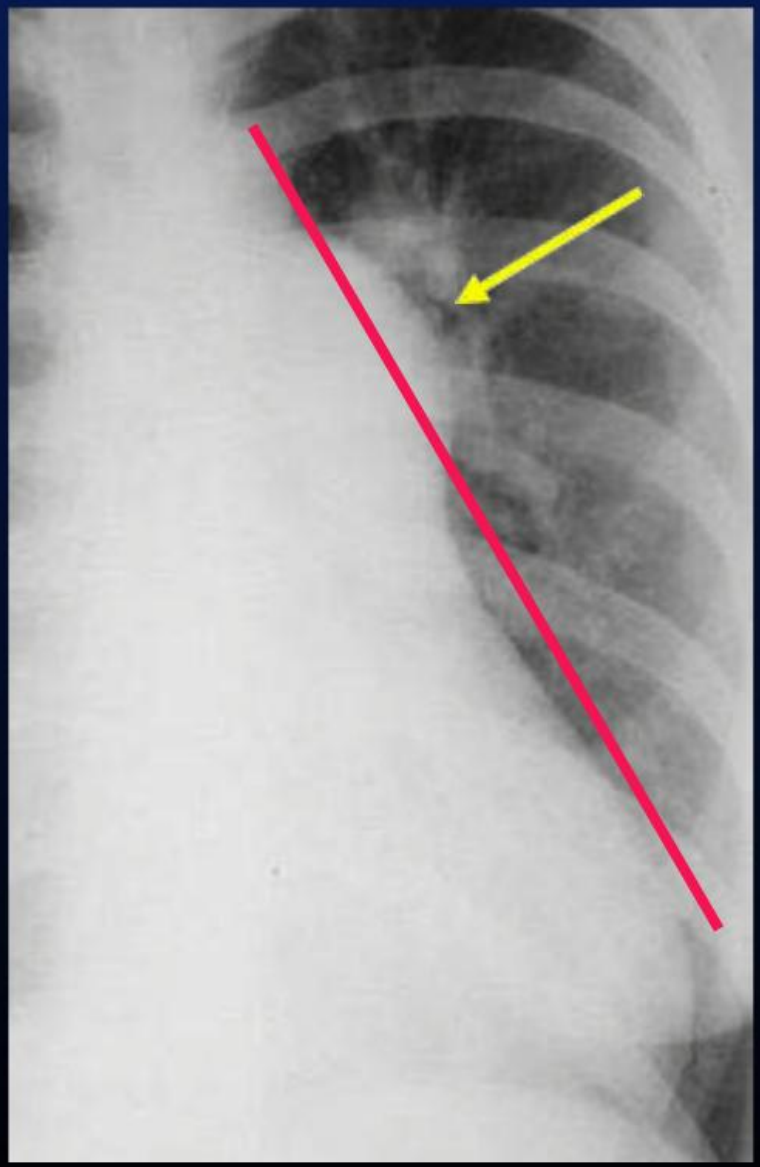
The distance between the tangent and the main pulmonary artery (between two small green arrows) falls in a range between 0 mm (touching the tangent line) to as much as 15 mm away from the tangent line

One possibility for the main pulmonary artery

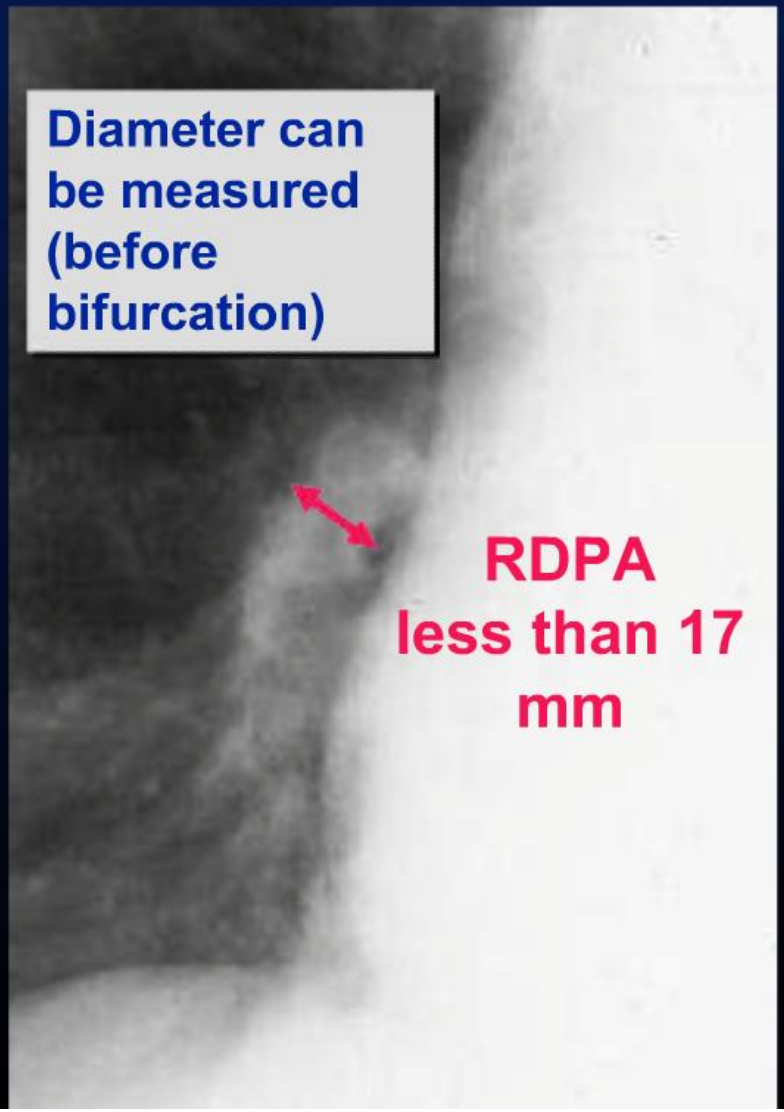
Main pulmonary artery projects beyond tangent line

Increased pressure

Increased flow

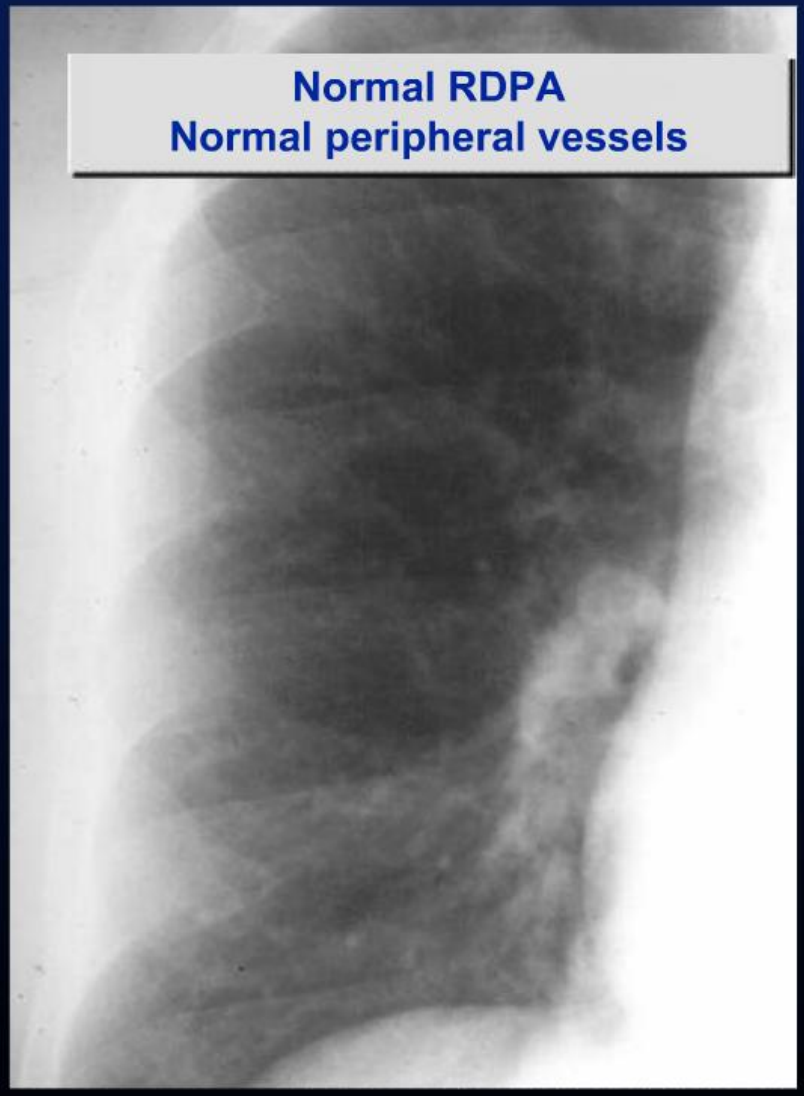


1. Right Descending Pulmonary Artery

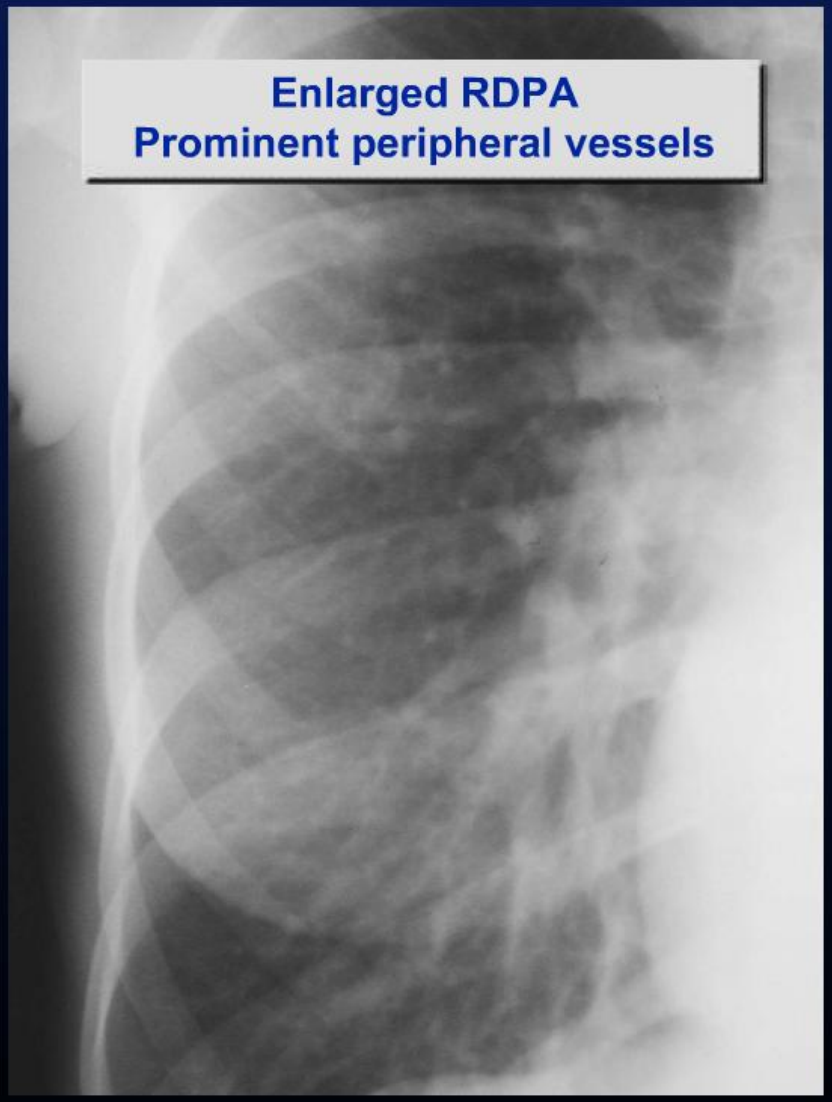


Normally, the right descending pulmonary artery should not be more than 17mm in diameter

Normal



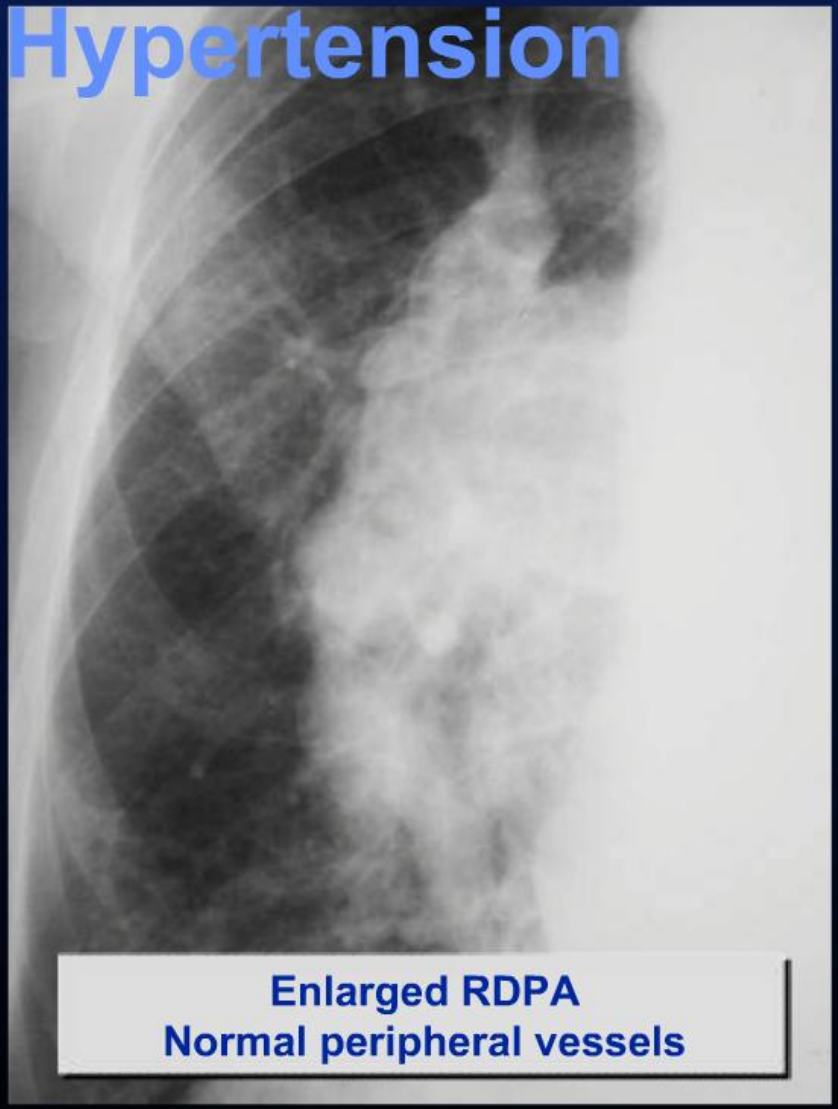
Increased Flow

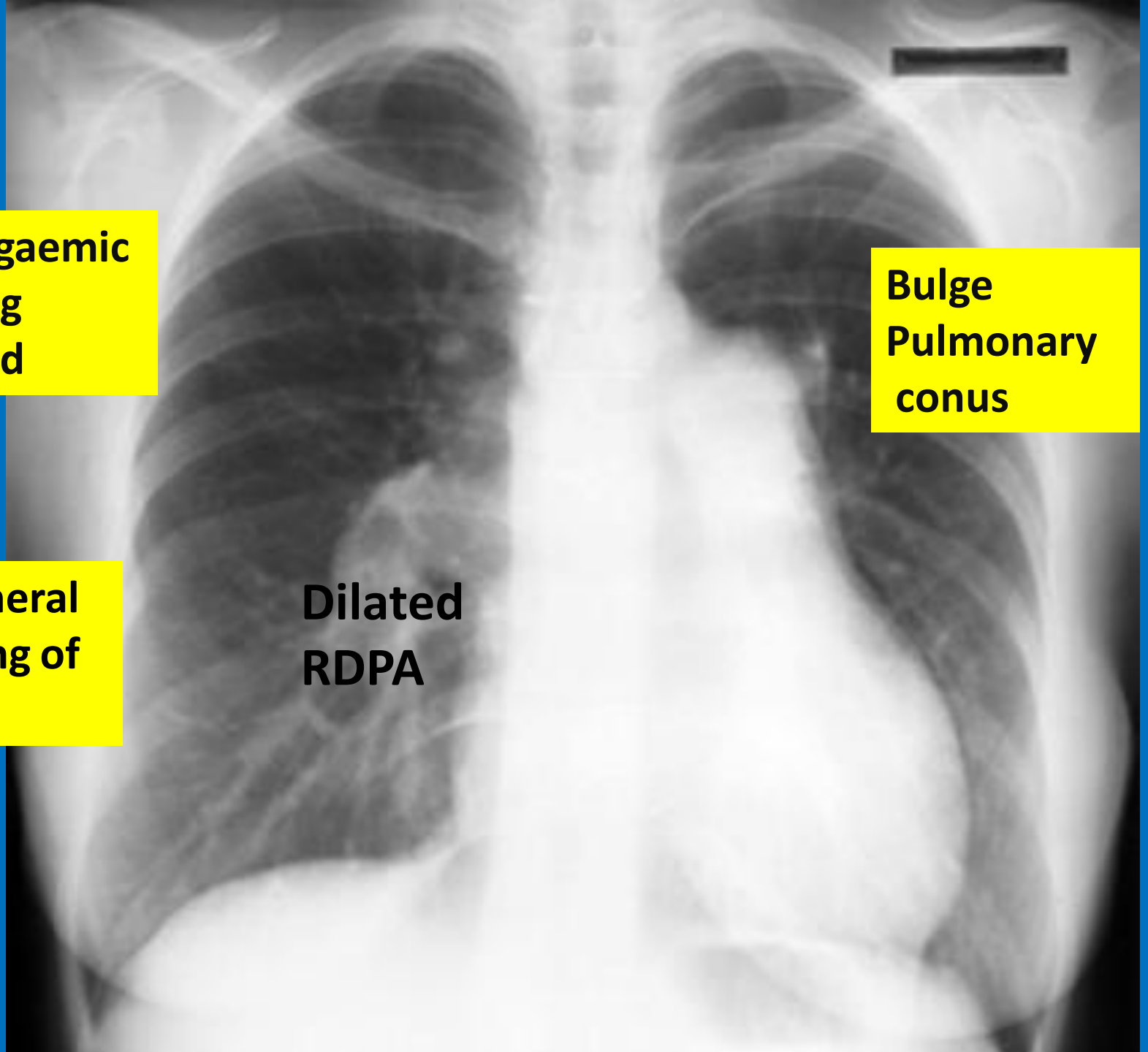


Increased Flow



Pulmonary Arterial Hypertension

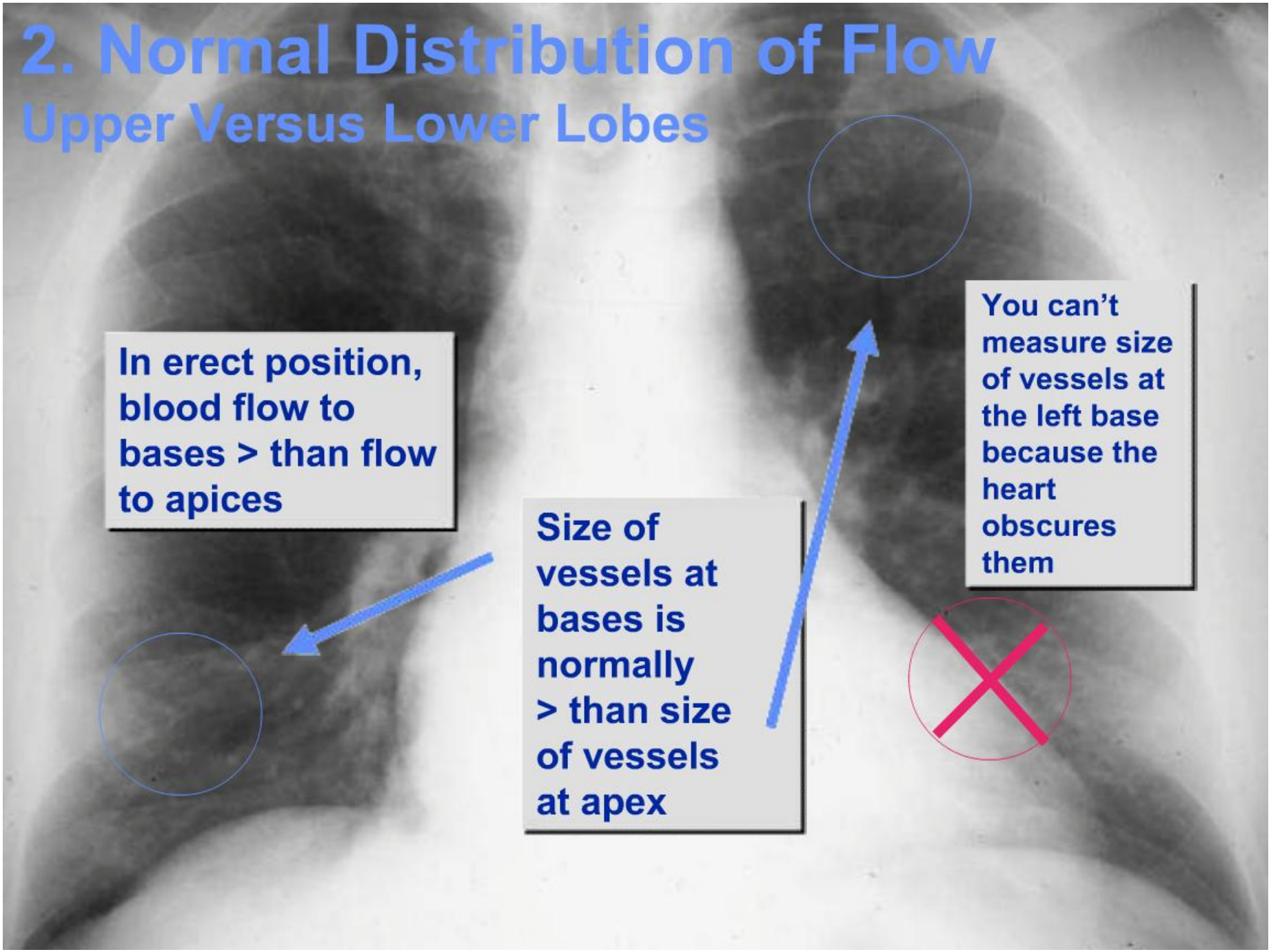


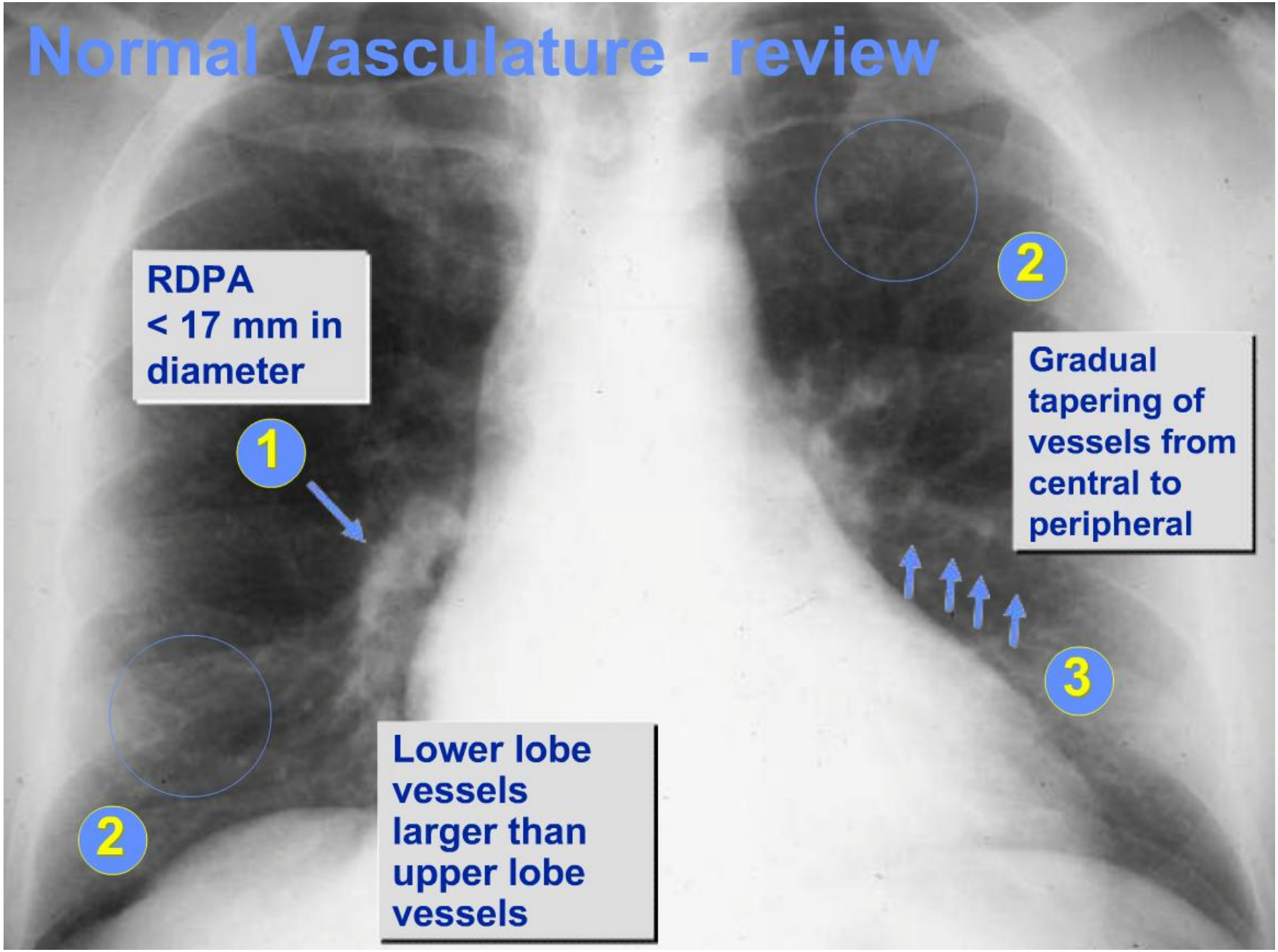

Oligaemic lung field
Bulge Pulmonary conus
Peripheral pruning of vessel
Dilated RDPA

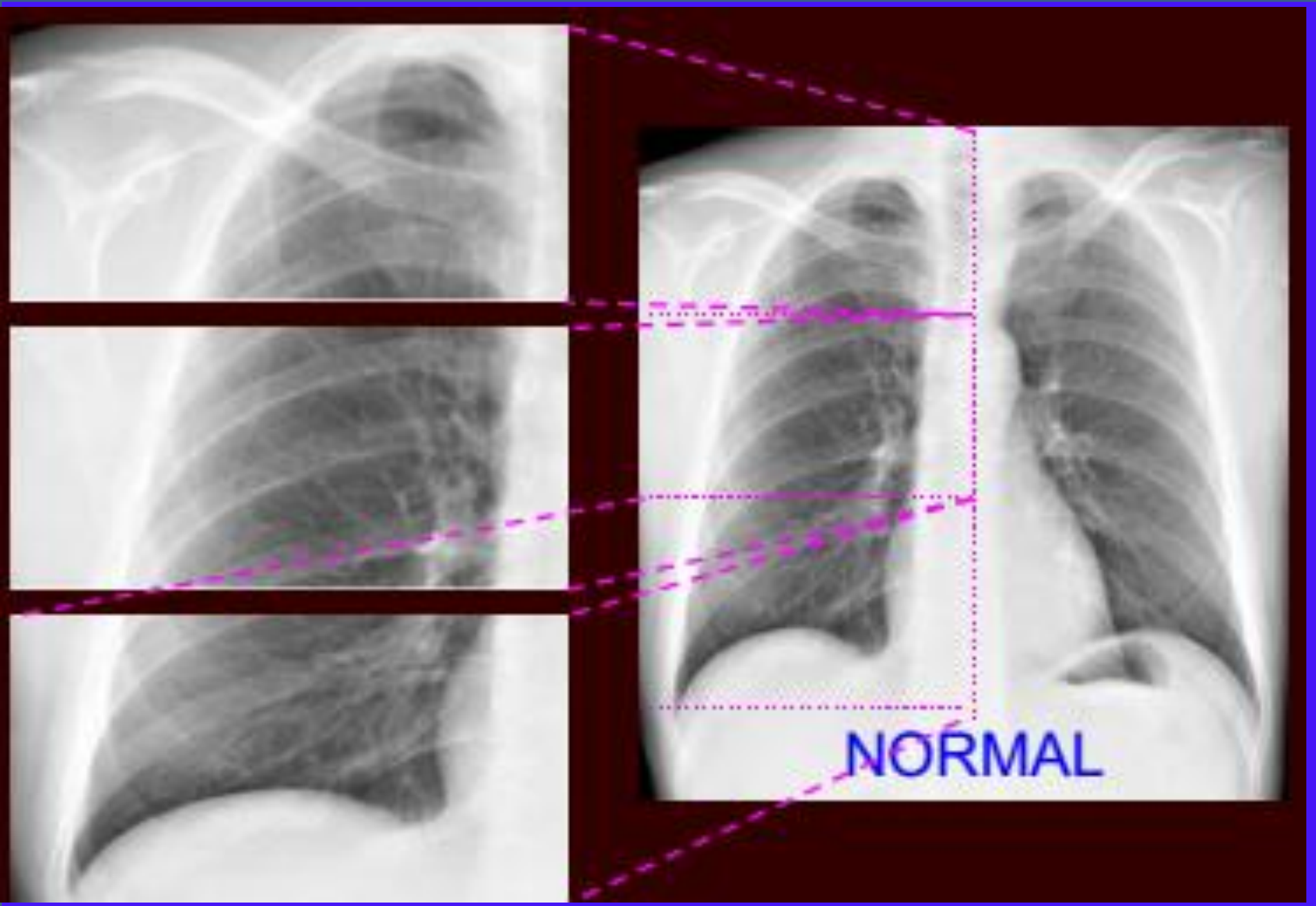
Normal blood flow to lung

2. Normal Distribution of Flow

Upper Versus Lower Lobes



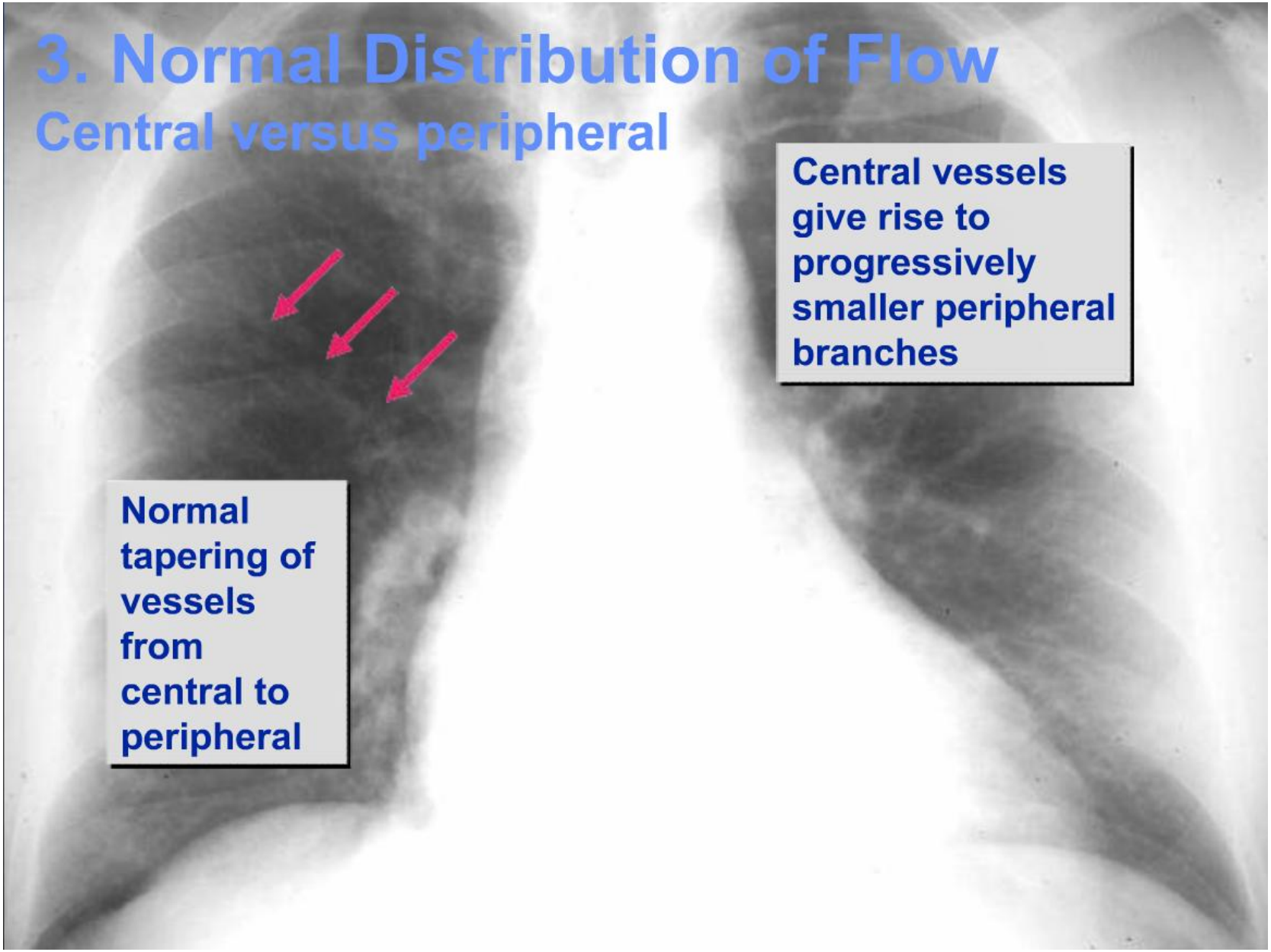

Normal Vasculature - review
RDPA
< 17 mm in
diameter
1
2
Gradual
tapering of
vessels from
central to
peripheral
3
2
Lower lobe
vessels
larger than
upper lobe
vessels



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3. Normal Distribution of Flow

Central versus peripheral



Pulmonary Vascular Pattern





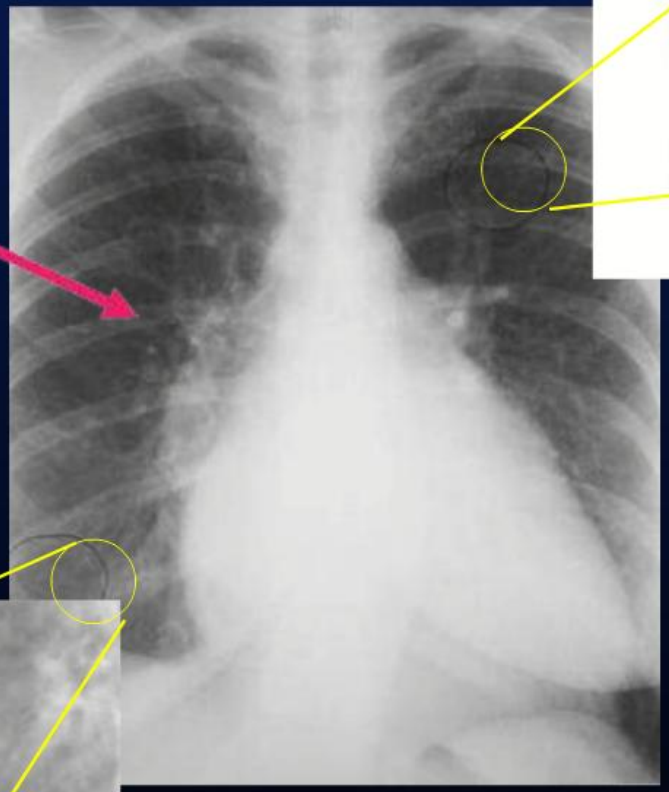
NORMAL

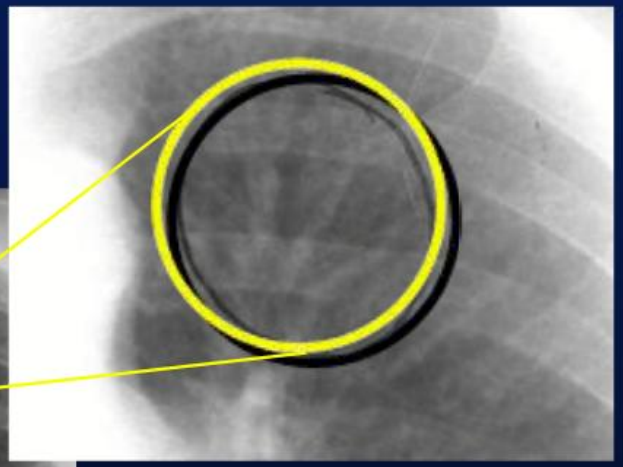
- major arteries
  - -central, the clearly distinguishable midsized pulmonary arteries (third or fourth order branches) are in the middle zone
- small arteries and arterioles
  - -normally below the limit of resolution
  - -in the outer zone.
- visible small and midsized arteries
  - -sharp, clearly definable margins because of the sharp border between water density and air density structures.

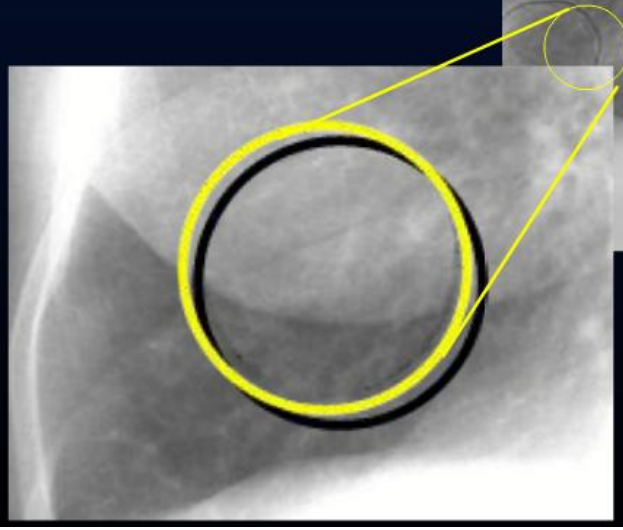
Pulmonary Venous Hypertension

Venous Hypertension

RDPA usually
> 17 mm







In pulmonary venous hypertension, the upper lobe vessels become equal to or larger than the size of lower lobe vessels = Cephalization

Pulmonary Arterial Hypertension

Pulmonary Arterial Hypertension

RDPA usually greater than 17 mm



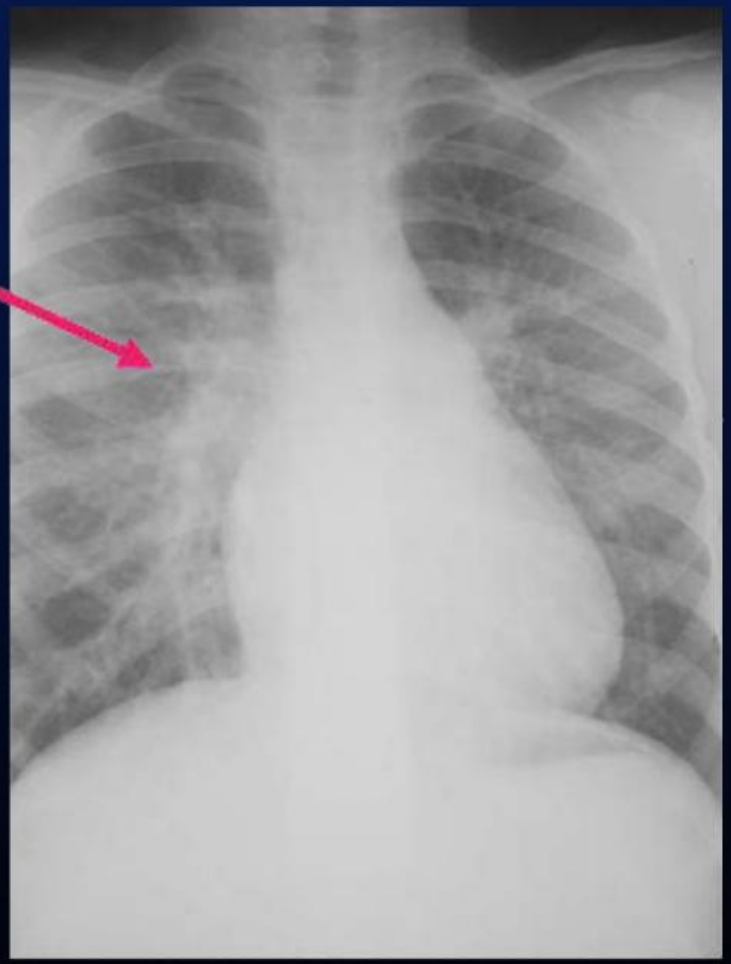
Main Pulmonary Artery projects beyond tangent line

Increased Flow To the Lungs

Increased Flow

RDPA usually greater than 17 mm

Since all blood vessels are carrying more blood than normal, all of the blood vessels everywhere in the lung enlarge

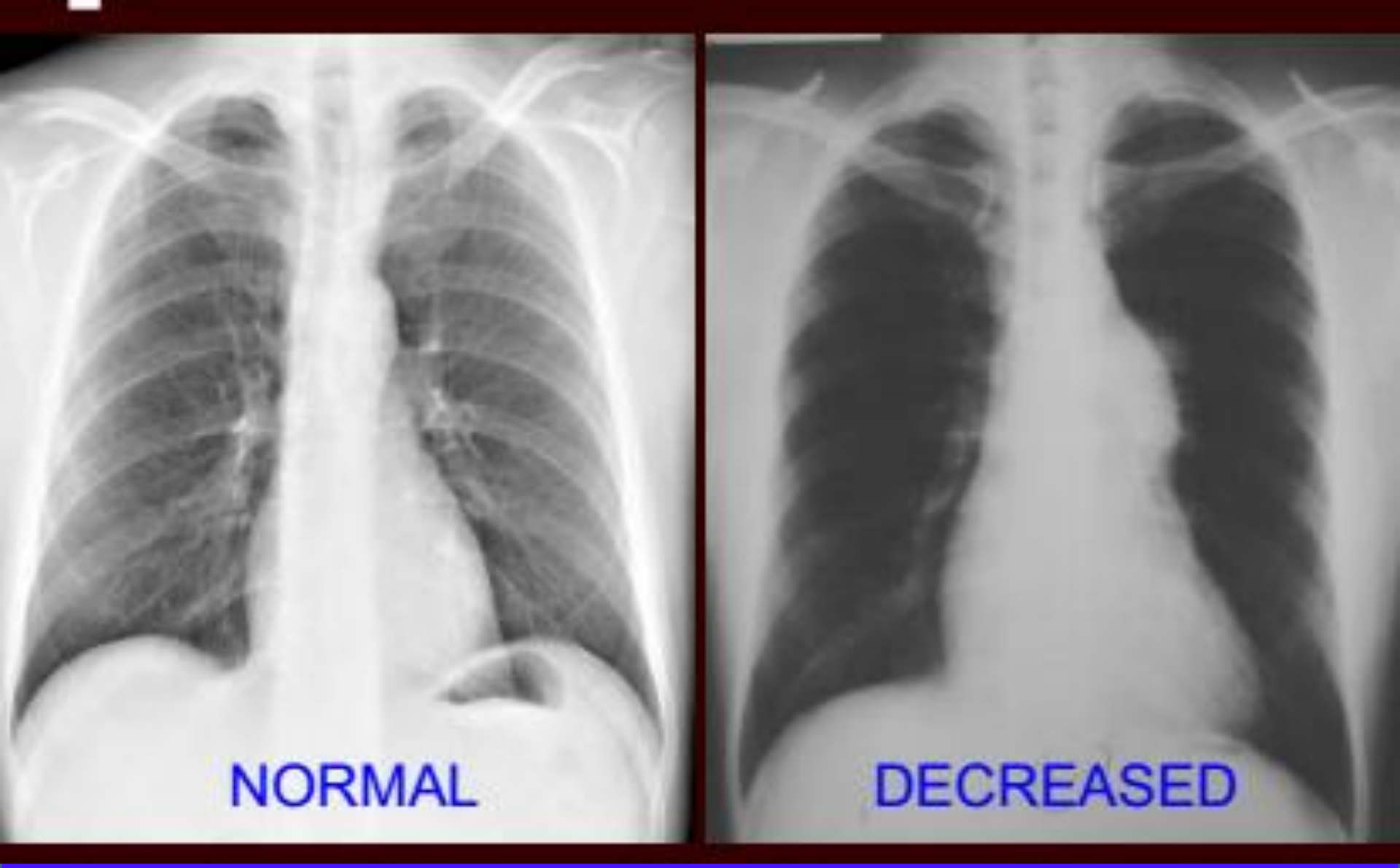


We see "more" blood vessels than in a normal person



Pulmonary Vascular Pattern

Dr. SHAMOL/Radio logy



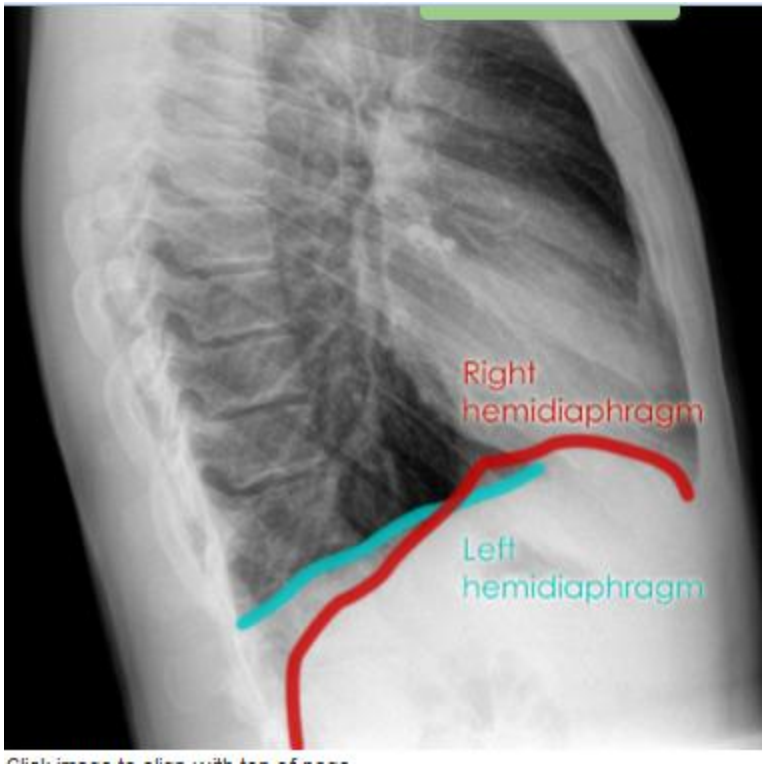
Dr. SHAMOL/Radio logy

major arteries -central, the clearly distinguishable midsized pulmonary arteries (third or fourth order branches) are in the middle zone

small arteries and arterioles
-normally below the limit of resolution
-in the outer zone. visible small and midsized arteries
-sharp, clearly definable margins because of the sharp border between water density and air density structures

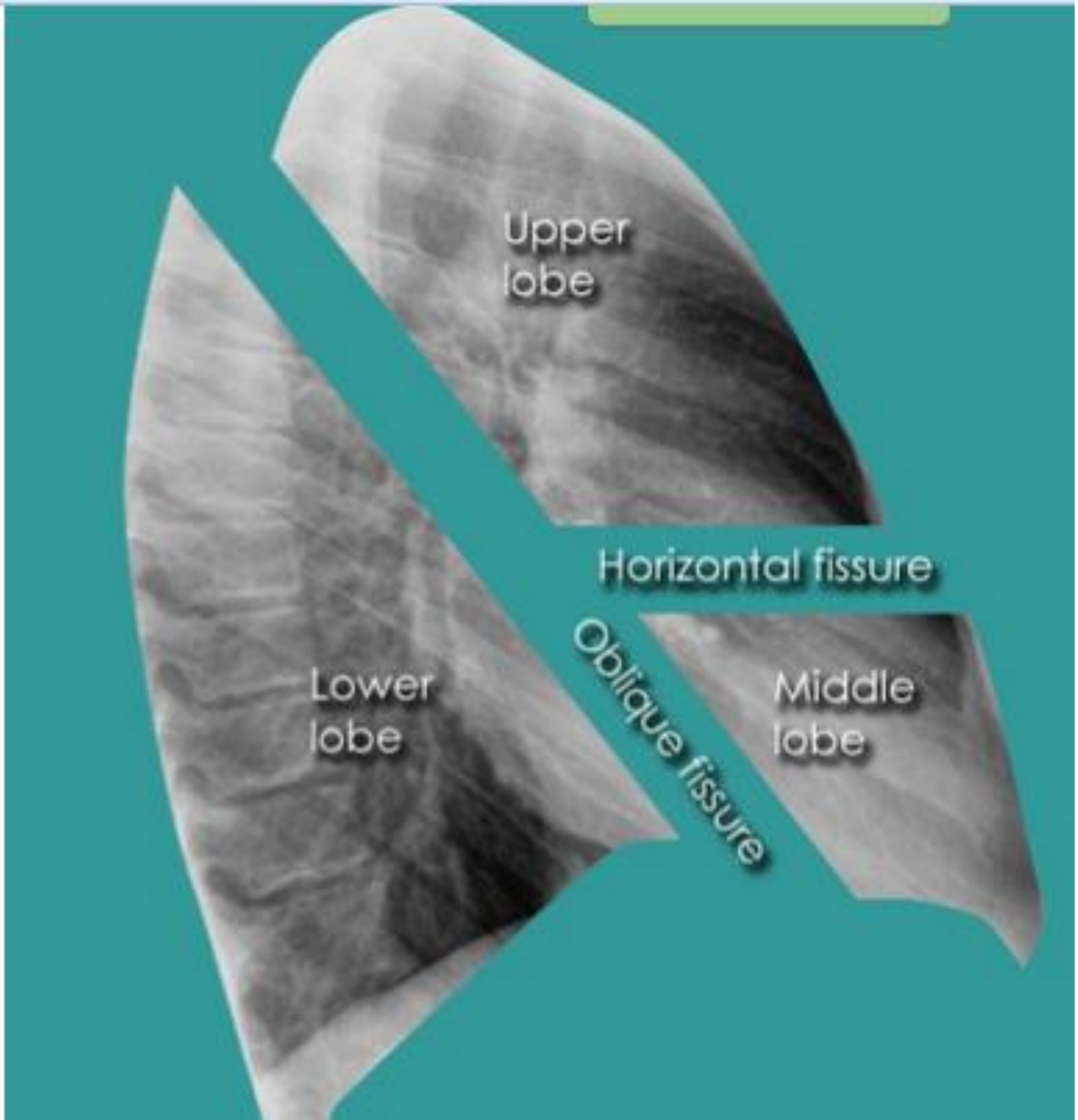

SOME LATERAL VIEW

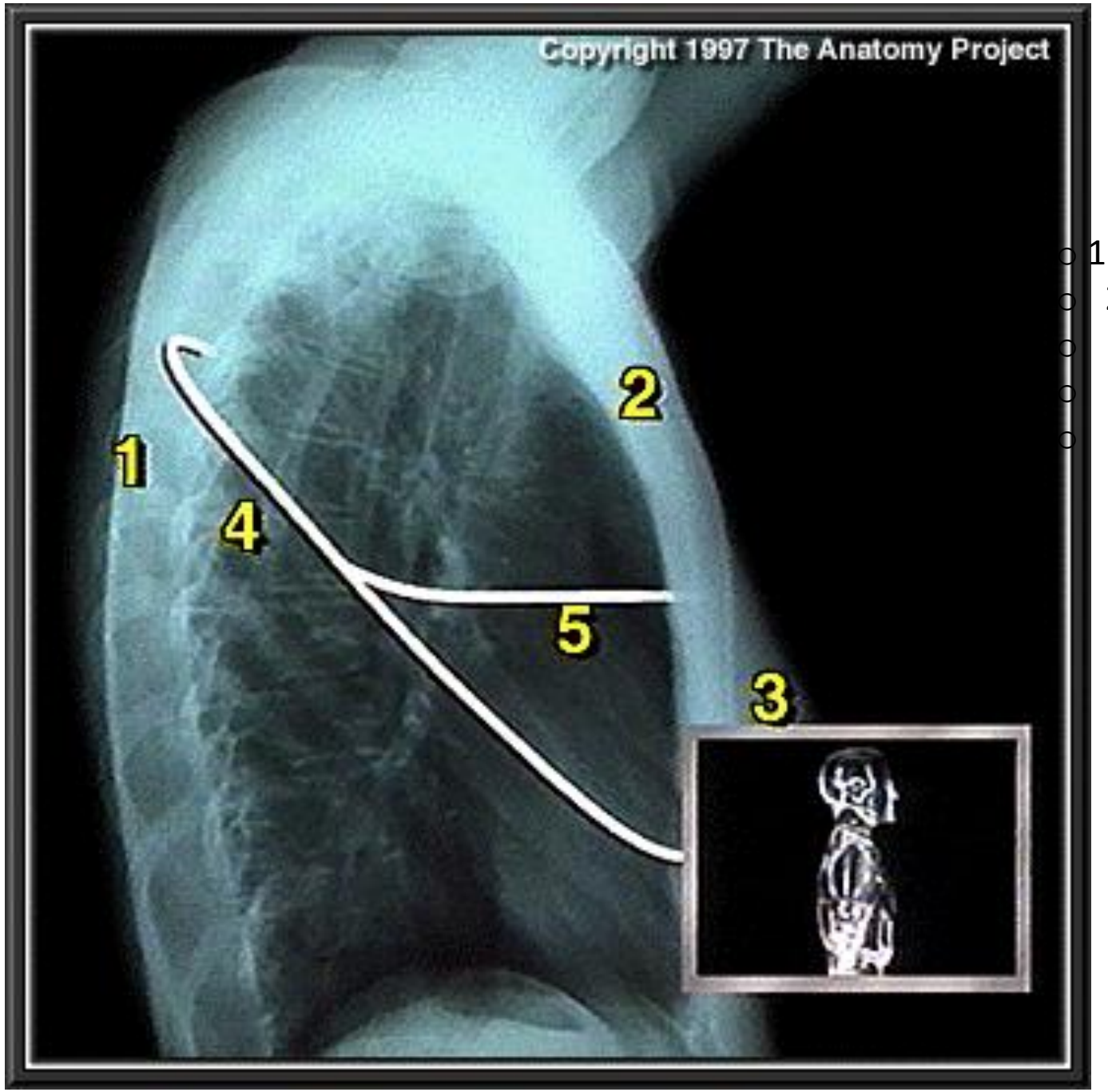




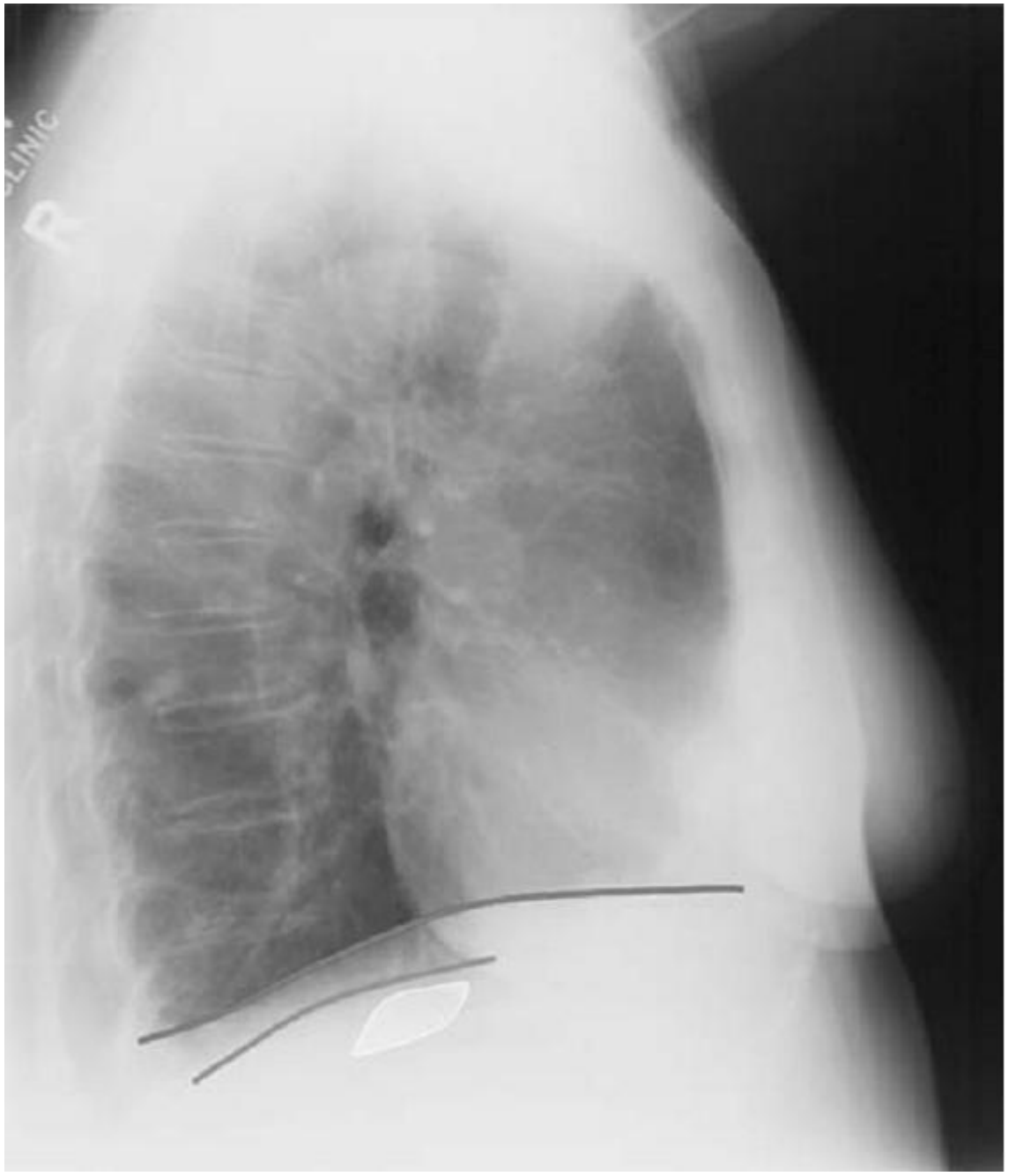
Hemidiaphragms - lateral view

The left and right hemidiaphragms are almost superimposed on a lateral view. Anteriorly the left hemidiaphragm blends with the heart and becomes indistinct.


Upper lobe
Horizontal fissure
Lower lobe
Oblique fissure
Middle lobe



- 1. Rib
- 2. Sternum
- 3. Breast
- 4 .Oblique fissure
- 5. Horizontal fissure



Diaphragms

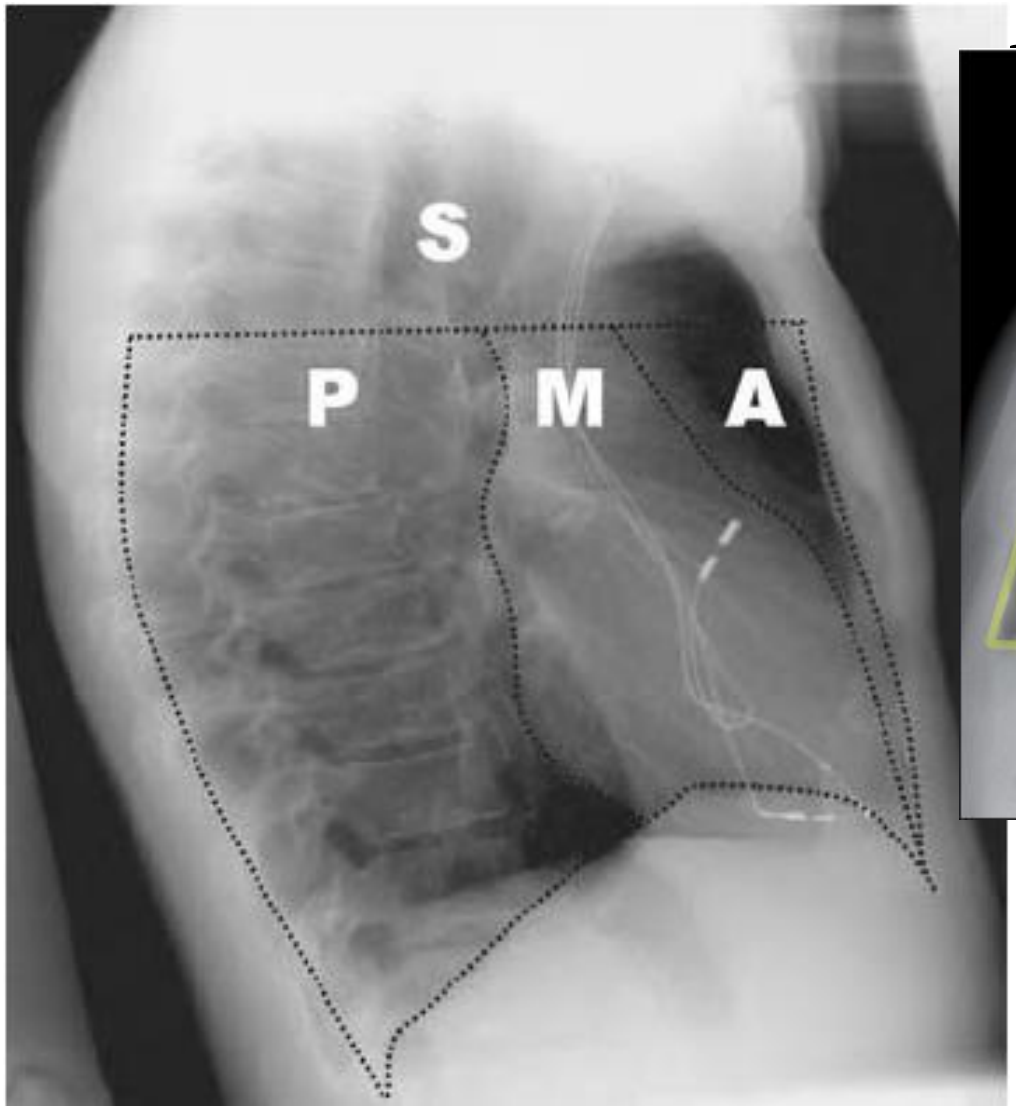
•The right hemidiaphragm is usually ‘higher’ than the left.

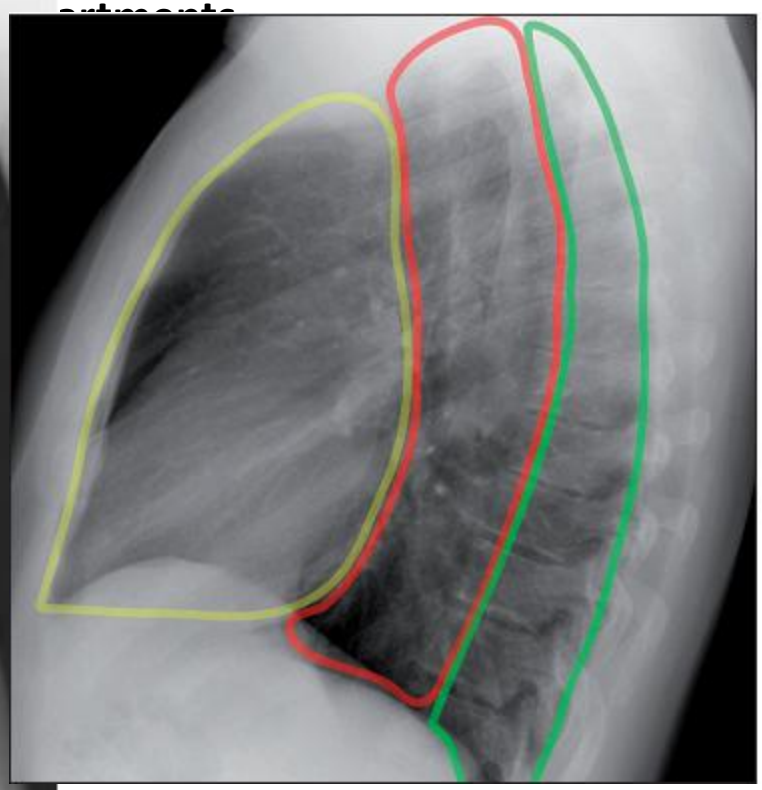
•The outline of the right can be seen extending from the posterior to anterior chest wall.

•The outline of the left hemidiaphragm stops at the posterior heart border.

•Air in the gastric fundus is seen below the left hemidiaphragm.

Lateral radiograph demonstrating the anterior (A), middle (M), posterior (P) and





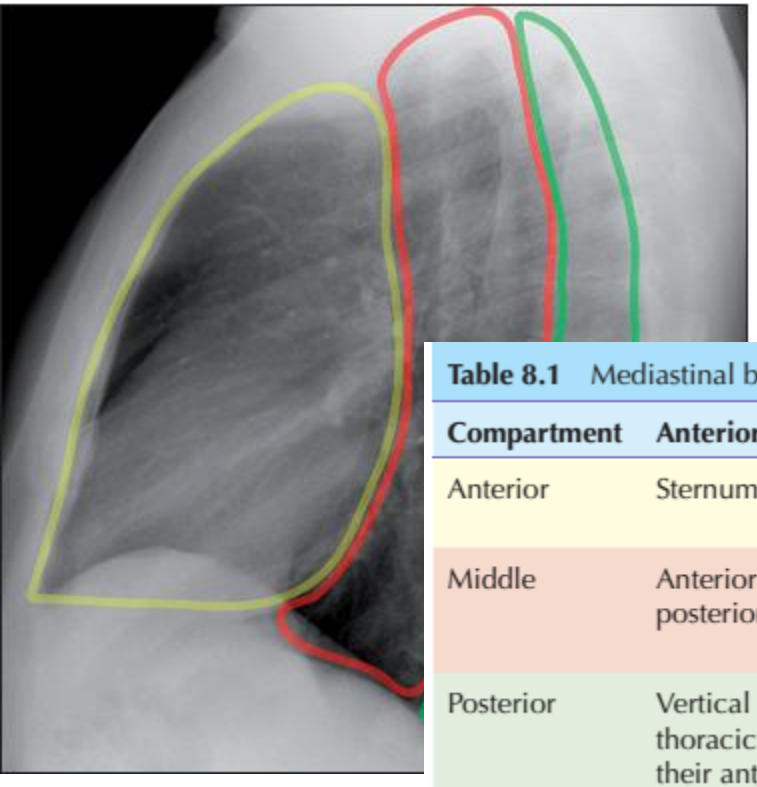


Table 8.1 Mediastinal boundaries.

Compartment	Anteriorly	Posteriorly
Anterior	Sternum	Anterior aspect of trachea and posterior margin of heart
Middle	Anterior aspect of trachea and posterior margin of heart	A vertical line drawn along the thoracic vertebrae 1 cm behind their anterior margins
Posterior	Vertical line drawn along the thoracic vertebrae 1 cm behind their anterior margins	Costovertebral junctions

Table 8.2 Mediastinal contents.

Compartment	Main structures / tissues
Anterior	Fat, lymph nodes, thymus/thymic remnant, heart, ascending aorta
Middle	Trachea, bronchi, lymph nodes, oesophagus, descending aorta
Posterior	Paravertebral soft tissues